FOOD MANUFACTURE

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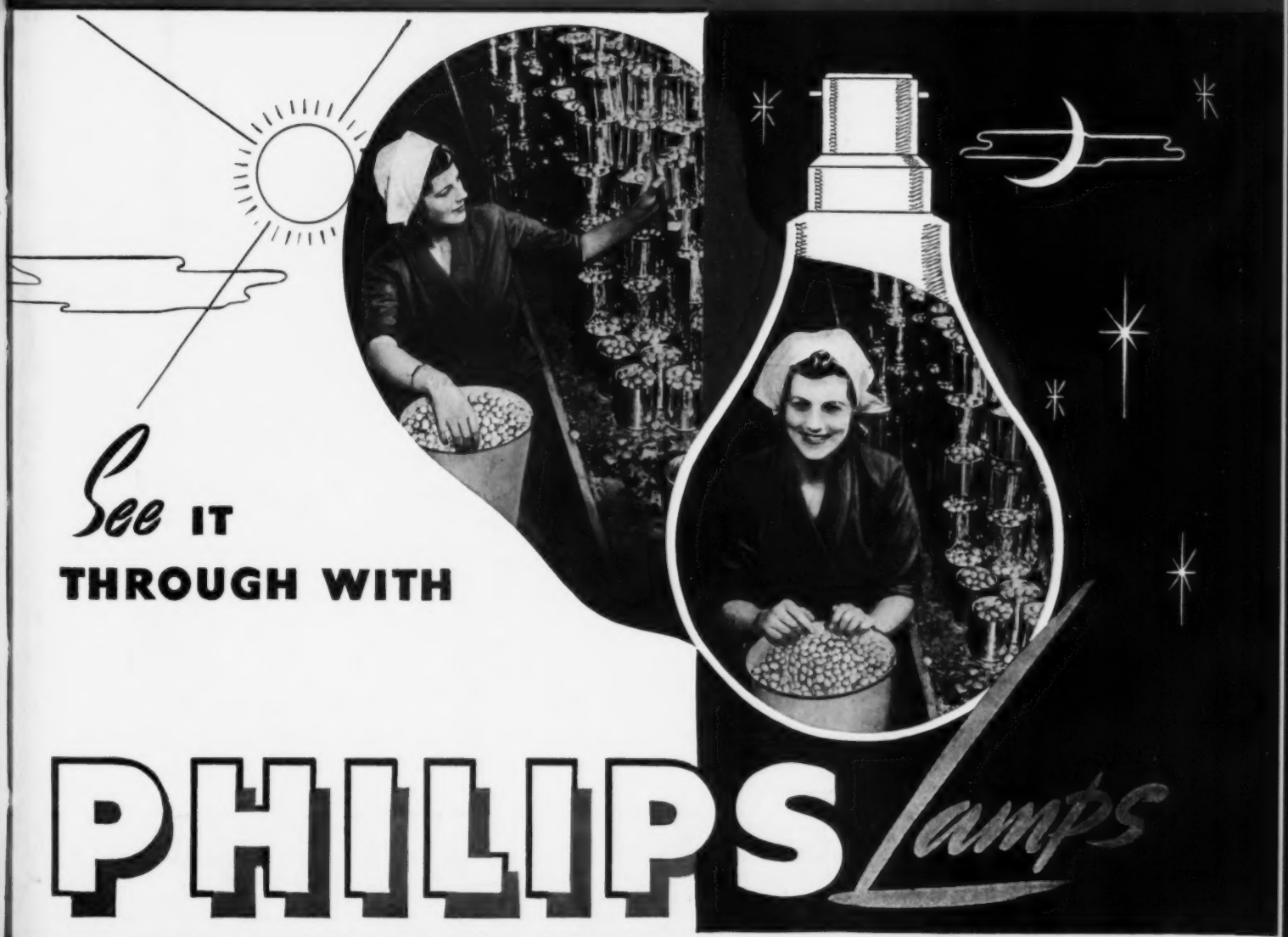


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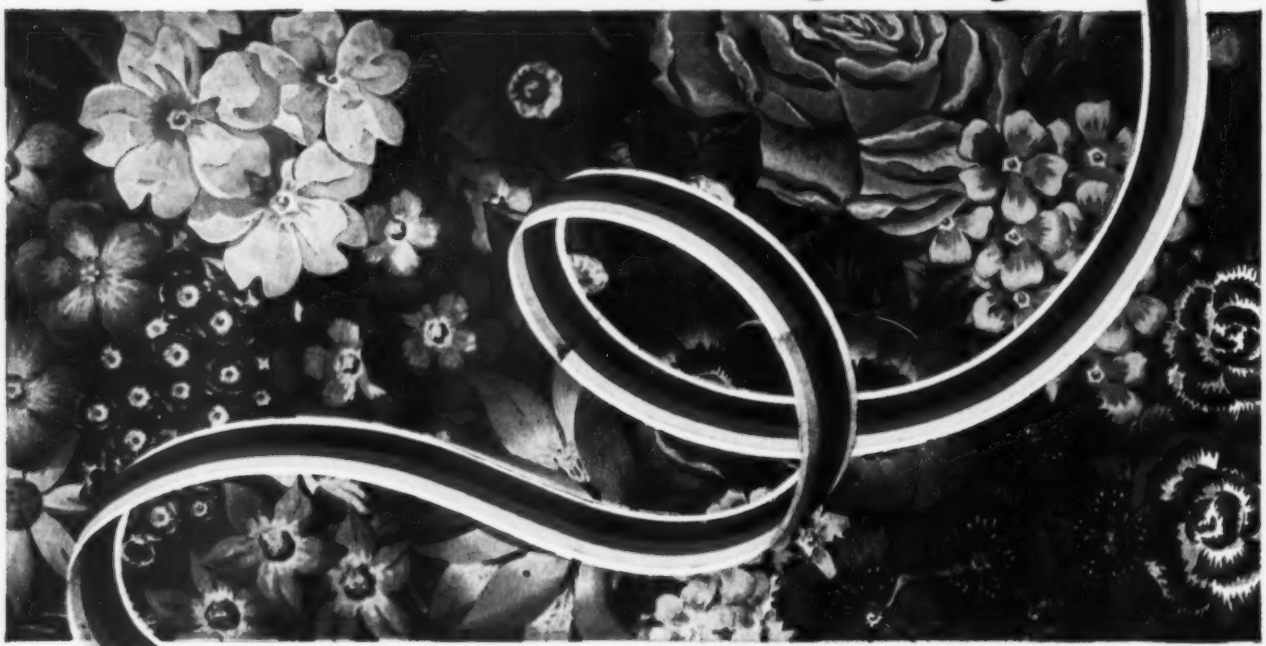

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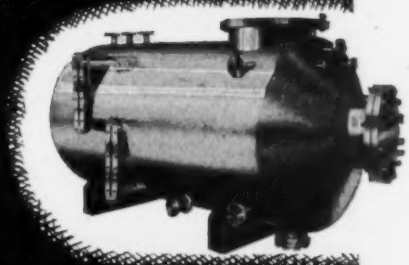

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# FOOD MANUFACTURE

VOLUME XVI. No. 11 NOVEMBER 1, 1941

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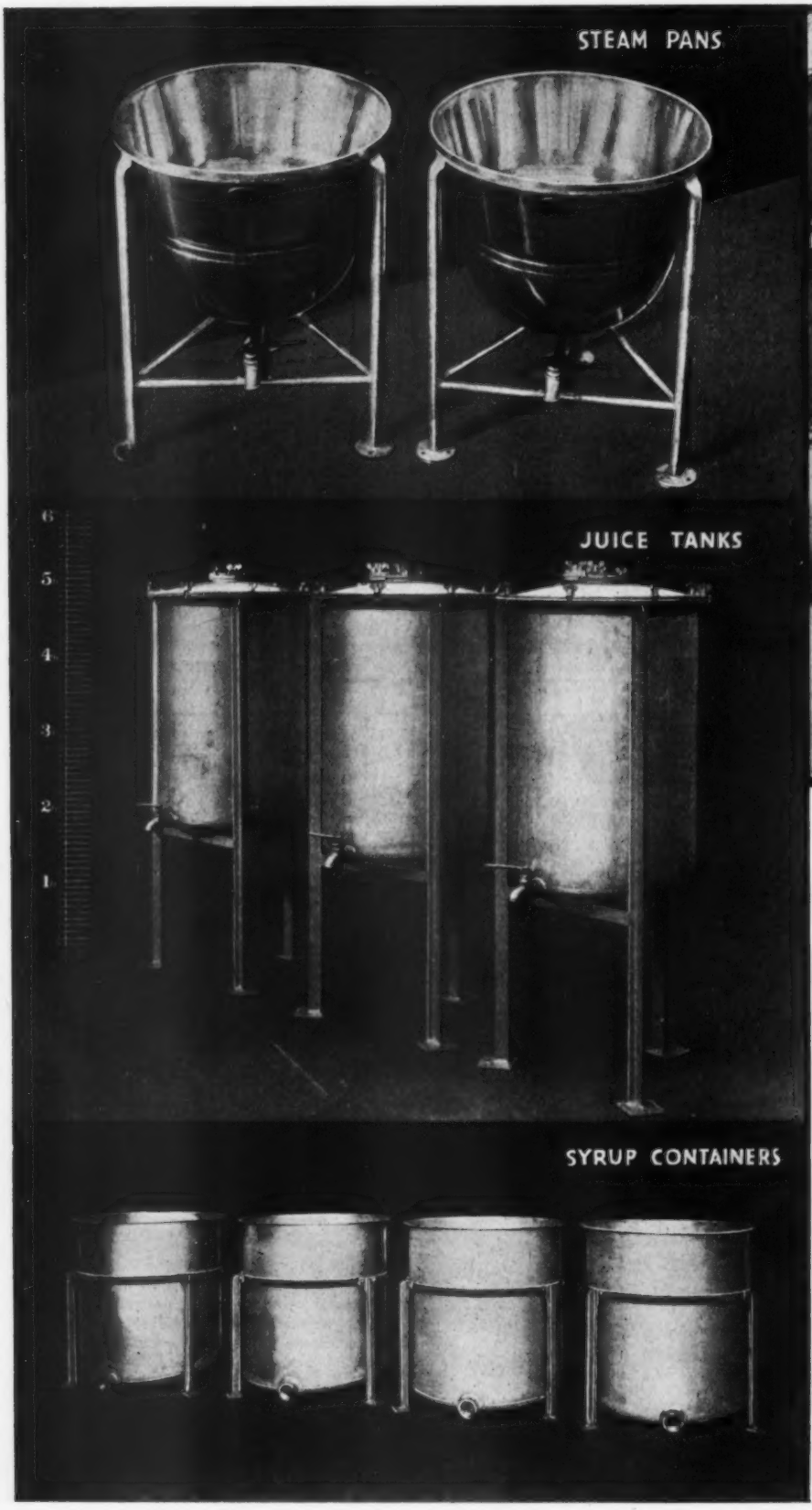


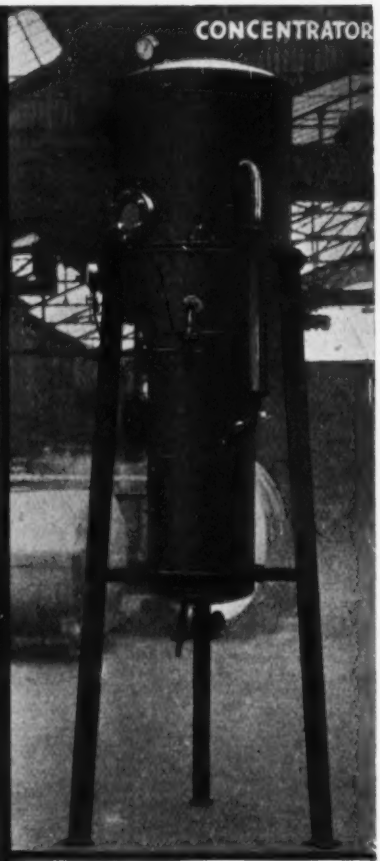


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# FOOD MANUFACTURE

Vol. XVI, No. 11 November 1, 1941

## *Food Substitutes*

THE MINISTER of Food has recently announced the forthcoming issue of an Order relating to the sale of worthless food substitutes and, while all reputable manufacturers will welcome this announcement, there can be nothing but dismay at the *non possumus* policy of the Government until things have got into such a state of confusion that legislation has to be introduced.

The necessity for genuine substitutes for a multitude of purposes invariably becomes apparent when the regular supply is interfered with for any reason, whether this be caused by a drought, by a war or by any other unforeseen circumstance. In his Annual Report for the year 1940 Mr. Bullock, the Public Analyst for Leicester, draws attention to the sale of a product sold as a substitute for milk powder, which had been imported from Holland before that country was overrun by the Germans, and which was so compounded that the Dried Milk Regulations were avoided. Mr. Bullock sums up the situation by saying that the "present food legislation is not too helpful to Public Analysts to protect the public from many of these special lines, but first-hand experience of many of them confirms one in the aptness at the present time of the Latin tag *caveat emptor*".

Mr. Bullock writes from the standpoint of the public analyst, but FOOD MANUFACTURE views these matters from the angle of the genuine food manufacturer who has to obtain permits from the Ministry of Food for supplies, has them altered from time to time and at the same time endeavours to do his best for a legitimate trade. Not only does he spend a considerable amount of time finding out whether a description would be considered genuine or not, but he has to compete with fraudulent substitutes, which are able to flourish under the very eye of the law.

Some genuine substitutes have been placed on the market and manufacturers have suddenly found the supply of one ingredient cut off by the Ministry of Food. Having spent a considerable amount of time preparing their formulæ, packaging and advertising matter, and having a considerable amount of the material in stock, they are confronted with the difficulty of discarding the line altogether or of making an inferior one. Unfortunately, some have succumbed to the temptation of taking the second decision, largely because they have found that they are in competition with mushroom growths, which stand to lose very little if they are fined or even closed down, in which case they will merely reopen business under another name.

Reputable firms find that when they market lemon substitutes containing over 40 per cent. of citric acid, they are in competition with other products composed of about 4 per cent. phosphoric acid and a trace of citric acid to blind an inexpert analyst or a magistrate, and, moreover, have to sell to a public unable to differentiate between the two products. Egg substitute powders have been recognised for nearly half a century, but the situation becomes entirely different when eggs get scarce and something is required to take the place of eggs in a capacity other than that of a mere baking powder. If coloured baking powder is permitted to be sold as an egg substitute, why should not a similar article containing a gum capable of imparting many of the egg effects in cooking foods be sold as a better substitute? If cornflour is recognised as the ingredient required to produce a blancmange and wheat flour only is obtainable, can one be described as selling a "genuine" substitute when wheat flour is employed, or not?

If the Ministries of Food and Health are not prepared to be more helpful and are going to be content to leave these awkward decisions to local benches of magistrates, who know less of the implications involved than they do themselves, it is doubtful whether any tremendous advance will be made in the present situation by the issue of fresh Orders. Manufacturers and Public Analysts have for years demanded that a Joint Committee be set up at the Ministry of Health to decide on standards for food products. Never was the demand for such a committee more imperative than now, when such a state of confusion exists.

## *Science and Humanity*

Reduced to its simplest terms, the theme of the British Association's three-day conference at the Royal Institution might be described by the peroration of Mr. Herbert Morrison's speech: "Shall mankind become the master of material things, or shall it continue to be tossed hither and thither by surging and misconstructed economic forces? Both our dignity and our interest require that we shall be the directors, and not the victims, of technical and scientific advance."

He reminded us of the mournful fact that the people of this country were, partly through ignorance, partly through poverty, still well below optimum food standard, and that the health, growth and expectation of life would all be greatly improved if we could attain that standard.

The degree of expansion of agricultural production which would be needed in order to bring the nutrition of the whole population up to standard, was illustrated by some striking figures by Sir John Orr, and he argued that the policy of meeting nutritional needs everywhere would rule out any danger of an agricultural slump for many years to come. He deprecated stupid political measures which have been restricting food on the assumption that there would be a glut, and called attention to the need of scientific measures of production and distribution according to need. He predicted that, after the war, Europe would be faced with the greatest catastrophe which had ever happened in history, and Governments of the Allied nations should here and now appoint an international committee to work out a world-wide food policy, based on human needs.

Sir John Russell was of the opinion that the destruction of the soil in Russia, due to the war, was not likely to be serious. Russian scientists had developed soil classification and surveying to a high pitch.

The reconstruction of agriculture, however, would be very difficult. Russian plant breeders had produced numerous varieties of crops specially suited to their different regions, and it would be a tragedy if all these varieties were lost.

With regard to the effects of the conference, Dr. Huxley said that it might lead to London becoming the scientific centre of the world.

A feature of the conference was the stress which had been laid upon the necessity for the employment of science and scientific technique in the post-war period, but it was necessary that the science involved must be free and international.

## Alkalies Save Sugar

From time to time during the past few months the suggestion to use sodium bicarbonate in cooking acid fruits has been given in broadcasts and in the Press, but the practice, so useful in these days of sugar rationing, has not been widely adopted.

From the known instability of ascorbic acid in alkaline solution it is generally proclaimed that on no account must bicarbonate of soda be used in cooking fruits and vegetables. However, although vitamin C is rapidly oxidised in alkaline solutions and is less stable in neutral than in acid solutions, it does not necessarily follow that it is completely unstable in an acid fruit that has been partially neutralised by the addition of small amounts of sodium bicarbonate.

With fruit the chief advantage of partial neutralisation of the acids is the reduction of the amount of sugar required to make the cooked product palatable.

In a recent paper by Drs. L. W. Mapson and J. Barker (*Chemistry and Industry*, September 6), they record a series of experiments conducted to determine the influence of the addition of alkalies on sweetness, flavour and vitamin value of cooked product.

The experiments were made on rhubarb, gooseberries, black-currants, red-currants, raspberries, plums and blackberries, and it was found that from 20 to 40 per cent. of the sugar required to make the fruits palatable was saved by adding a small quantity of sodium bicarbonate either before, or preferably after, cooking. It was found that only small losses of vitamin C resulted, these varying from 0 to 13 per cent., except in the case of black-currants and red-currants; when the alkali was added before cooking they were from 20 to 25 per cent., although when added after cooking the losses were of the same order as the other fruits.

The amount of bicarbonate recommended is 0·3 to 0·4 gm. per 100 gm. of raw fruit, but with gooseberries and black-currants from 0·6 to 0·9 gm. per 100 gm. may be added.

The authors are to be congratulated on having put a very useful practical device for saving sugar on a scientific basis.

## Food Chemistry in Relation to Ageing

Gerontology—the scientific study of the phenomena of senescence—was the subject of a symposium at a recent meeting of the American Chemical Society, Division of Biological Chemistry, at which, among others, Drs. E. J. Stiglitz and H. C. Sherman read papers.

Very little is known of the basic mechanisms of ageing as a biological process, and the senescence of man as an individual has received scant attention in contrast to the interest in growth. The increased longevity of our population can be made the basis for splendid advance if long years are paralleled by health and productiveness, but it is also a potentially disastrous menace if the chronic, progressive and disabling disorders of later life are not controlled. In the present chaotic state of world affairs, preventive geriatrics takes on additional significance. It must not be forgotten that the wisdom of older men in positions of grave responsibility represents an invaluable national resource. The conservation of the health and vigour of these almost irreplaceable individuals is a major responsibility of preventive geriatrics.

In studying, by means of laboratory animals, the effects of chemical differences in the food upon nutritional well-being throughout life, ageing may be indicated by the outward appearances, the decline of muscle tone, and the cessation of the ability of the females to reproduce. Starting with a diet of little more than minimal adequacy, an increase of intaké of either calcium, riboflavin or vitamin A deferred the time of ageing and increased the length of life. The results thus far also afford tentative indications that some of the chemical factors, while essential to normal nutrition at all ages, may have relatively different significances for different segments of the life cycle.

## Concentrated Fruit Products

The Annual Report for 1940 of the Agricultural and Horticultural Research Station, Long Ashton, contains full reports on the production of concentrated apple juice and treacle and concentrated plum products, references to which have been made from time to time in Food Manufacture.

The technique of production of concentrated apple juice is fully described. A number of widely differing varieties of apples were used and experiments were carried out on bulks of low-grade apples that would normally have been surplus. One particularly interesting set of experiments was concerned with the recovery and return to the product of volatile constituents (mainly responsible for the flavour of the fruit) carried off by the steam during the process of evaporation.

The continuation of work on the production of apple treacle, reference to which was made in the 1939 report, is described, and another section tells of a new method for preventing gel formation during the vacuum concentration of apple juice.

Concentrated apple products made in 1939 and 1940 have been in great demand from the confectionery, mineral water and food industries, and the supplies have been hopelessly inadequate to meet their combined requirements. A series of laboratory experiments were carried out at Long Ashton and a comprehensive series of recipes were worked out by the Research Department of the Metal Box Company, using apple products made at Long Ashton.

Some recipes for using apple treacle in jam and jelly making are given in the report.

The production of concentrated juices from fresh plums and from fruit preserved with sulphur dioxide is discussed in detail. Attractive *purées* and powders have been obtained, and one firm of preserve manufacturers is stated to have prepared an attractive range of products supplied by Long Ashton.

An important point about the powdered product is that the contained pectin retains its setting power, and attractive jams can be made merely by the addition of sugar to the *purée* reconstituted to the required strength by diluting the powder with water.

Among other papers is a note on the production of black-currant juice and its suitability as a source of vitamin C.

## Vegetable Dehydration

In view of the interest exhibited in the matter of drying vegetables in this country, an article appearing in *Food Industries* (U.S.A.), September, 1941, by Dr. L. V. Burton, the editor of the journal, is timely.

He states that it is doubtful if the basic knowledge upon which successful vegetable dehydration is based would have been gained had it not been for the experience gained in the quick-freezing industry.

Quick-frozen vegetables were not satisfactory until enzyme control was adopted. Dehydrated vegetables suffer enzymic deterioration as did quick-frozen ones until preliminary blanching was carried out.

Dr. Burton describes the operation of a pilot plant of the Dry Pack Corporation, the working of which has proved that a reasonable profit can be made while at the same time underselling either canned or frozen vegetables.

Essentially the procedure is a tray-drying operation with very accurate automatic control of humidity, temperature, rate of air movement, amount of re-circulation of air, and time of the cycle. In general the drying cycle is 3½ hours, which, with time allowed for loading and unloading the trays, permits six cycles per 24 hours. In the case of apples, 35,000 lbs. of steam is needed to produce 3,000 lbs. of dried apples. This production is equivalent to 13 per cent. of the original put-in weight. For products such as peas, beans, corn, onions, etc., the figures are roughly comparable.

The heart of the whole process is the application of the data mentioned above, which varies with every type of vegetable.

## *Lord Dawson Stresses Eggs as Food*

In the House of Lords recently, Lord Dawson urged the need of stimulating poultry farming. He said that the egg was of very great value from a nutritive point of view, and could bear comparison with milk, being rich in protein and vitamin. It could be said that together milk and eggs were a veritable tower of nutritive strength. So great was the importance of the egg that it was a mistake to penalise its production, for all authorities were agreed that without milk or eggs men could not work as they could otherwise. It was right that there should be a priority of eggs for children and some invalids, but from the point of view of preventive medicine and of keeping the active population well and fit during the war, we could not overlook the fact that the availability to them of eggs would play a big and important part. He earnestly hoped that the Minister of Food would take no steps further to ration eggs. Rather should he leave it to localities to try, by voluntary effort, to look after the egg needs of their children and ailing citizens.

## *Protein for Feeding Stuffs*

Reviewing the sources of protein for feeding animals and poultry, Lord Dawson declared that it was important that we in this country should produce protein-rich food, suitable for our animals and hens, not next year but within the next two or three months. In connection with the manufacture of acetone there was a by-product containing large quantities of protein suitable for feeding poultry and animals. This had been used to feed pigs and other animals in the last war, but at present it was a by-product which was being wasted.

There was also a synthetised vegetable protein of high value, made in part of dried yeast, the manufacture of which on a large scale might be expedited. Experience showed that this added to the value of bread, and that it was extraordinarily good in the nourishment of children. It would also help in the protein feeding of animals. He urged the Ministry of Food to hustle this thing on. The poultry farmers had been penalised by the reduction of feeding ration for poultry. Could not a further reduction be postponed for a little time?

## *Synthetic Peppers*

An interesting review of the means of producing synthetic peppers has been made by W. Sandermann (*Seifensieder-Ztg.*, 1941, **68**, 41), and would apparently indicate the continued interest of chemists in Germany in substitutes.

Peppery compounds in nature belong principally to the group of amides, and the acid and amine radicles may be combined in very different fashions. The predominating acid radicles are those of the unsaturated series, such as undecylenic, isodecylenic, decanoic, nonanoic and piperonylic acids, which are outstandingly effective. The pepperiness is greatly reduced or even destroyed if the acid is saturated. Another important factor is the steric arrangement—*e.g.*, chavicine (cis-cis) is much more peppery than piperine (trans-trans).

Isobutylamine, vanillylamine and piperidine are the natural amino components which also play an important part in producing the peppery flavour.

In synthetic products piperazine may be used to replace piperidine; in the last war Germany used the unsaturated acids 5-phenyl-2-pentenoic and 5-phenyl-3-pentenoic acids, as the chlorides in benzene, to act on piperidine to produce artificial pepper flavours. The compounds so produced were incorporated into powdered nut-shells or with clay, etc., and the product used as "pepper". The piperidine required can be readily obtained by hydrogenating pyridine, while piperazine is easily prepared by heating ethylene diamine hydrochloride. Another worker, H. Staudinger, has shown that the derivatives of $\delta$-phenylvaleric acid are to be preferred as being best in producing the peppery taste.

## *Phytic Acid in Flours*

A note in *Nature* by E. M. Widdowson, of the Department of Medicine, Cambridge, is of interest to millers. It deals with the activity of phytase (a digestive enzyme which will hydrolise phytic acid) in commercial flours. This enzyme may destroy phytic acid during the accepted cooking processes.

Research has established that the phytic acid/calcium rates determine whether a diet will promote the absorption of calcium and facilitate the production of rickets. (Harrison and Mellanby, *Biochem. J.*, 33, 1660 [1939], and McCance and Widdowson, *Spec. Rep. Ser. Med. Coun.* [1941]. In the Press.)

The author shows the destruction of phytic acid on cooking bread made from flours of 70 per cent. (white flour), 85 per cent. (National wheatmeal), and 92 per cent. (wheatmeal) extractions. White flour lost 85 per cent. of its phytic acid, National wheatmeal 69 per cent., and wheatmeal 31 per cent. when yeast was used. The use of baking powder produced less destruction.

It is concluded from the foregoing and other data that while the cheapest and most effective way of frustrating the noxious action of phytic acid is by adding calcium to flour, something can evidently be done by cooking in a suitable manner.

## *A New Nutrition Society*

For some time past there has been felt among workers engaged in research on nutrition in this country the need for a scientific society devoted specifically to their subject. No organisation has existed to enable investigators in the many and varied branches of the science—clinical, physiological, agricultural and sociological—to find a common meeting ground for discussion. Representative workers in all these fields accordingly decided to form a Nutrition Society, and a circular letter, signed by the heads of some of the better-known centres for research in nutrition, was sent to those likely to be interested. This was followed by a meeting at the Royal Institution and a provisional committee was formed.

It is not intended that the new Society should compete in any way with existing societies; its functions will be supplementary to theirs and would cover a more general and in some ways a less specialised field. It is proposed that the main activity of the Society should be to hold meetings at different research institutes, at each of which some specific topic could be discussed. The first conference was held at Cambridge on October 18, when the theme was "The Evaluation of Nutritional Status".

Sir Frederick Hopkins gave an introductory address and the scientific part of the meeting was opened by Dr. Leslie J. Harris, and many eminent specialists contributed to the subsequent discusion.

The meeting was an excellent one and exceedingly well attended. It is the intention to hold further meetings at approximately three-monthly intervals, at which will be discussed some broad aspect of nutrition.

## *British Material for Export*

Overseas readers are advised that the fact that goods made of raw materials in short supply owing to war conditions are advertised in FOOD MANUFACTURE should not be taken as an indication that they are necessarily available for export.

An undertaking has been given by the British Government that no materials of a type the use of which is restricted in the U.S.A. and of which Britain obtains supplies under the Lease and Lend Act will be used in export trade except in special cases. It follows that many materials used for the manufacture of products legitimately advertised in Britain may not be available to overseas buyers.

# THE DAIRYING OF THE FUTURE

**The real criterion of a reform is whether the nation as a whole will benefit from it. This article recommends certain sweeping alterations, but it is emphasised that some of them may have to await the conclusion of the war.**

JOHN G. DAVIS, PH.D., D.SC., F.I.C.
The National Institute for Research in Dairying, Shinfield, Reading.

THE REFORMS discussed in this article are concerned with the fundamental aspects of dairying in this country. They are, therefore, of permanent interest and largely independent of war conditions. Nevertheless, a state of war makes it all the more urgent to take stock of existing organisations and to improve these if such improvement can be shown to increase the efficiency of the industry. It is noteworthy that the writer has found that practically all persons in the industry are in agreement with the suggested reforms, although some have indicated that they feel that sweeping alterations are undesirable in war-time. We have had, however, many sweeping reforms already in this war, and it is possible to do in a short time under present conditions what would take many years in times of peace. The real criterion of a reform is whether the nation as a whole will benefit. This article has been written from a point of view of the industry in the year before the war, as there is no guarantee that war-time measures will continue afterwards. It may be emphasised, however, that the responsibility for the suggestions and conclusions is the writer's alone; no attempt is made to suggest that the opinions voiced represent those of any institution.

## Importance of Dairy Industry

When we consider the dairy industry of this country we are concerned with the most important aspect of our food supply and of our agriculture. Milk is our most valuable foodstuff and, from the economic point of view, is the life-blood of some three-fifths of our farmers (150,000 out of 250,000). In value, milk represents over one-quarter of our agricultural produce (£55 million out of £200 million [1938]), and it is unique in being practically the only important foodstuff which is 100 per cent. home produced. Its perishable nature, like that of fruits, vegetables and eggs, confers upon it a considerable natural economic protection. It is also noteworthy that our climatic conditions are eminently suited for the production of these foodstuffs, and that they are, moreover, " protective " foods. In fact, agriculture may be regarded as the practical solution of the problems of human nutrition, and dairying is of particular interest from the point of view of the nutrition of babies and children.

It is, therefore, a matter of national interest to ask if this industry is efficiently organised and managed. The answer can only be that with some exceptions it is backward and suffers badly from a lack of up-to-date knowledge and co-ordination of its many aspects.

## A Complex Industry

It is necessary to realise in the first instance the complexity of the industry. Dairying is a very wide term and covers the production of grass, roots and cereals, the breeding and care of dairy cattle, the production and handling of milk, its transport, pasteurisation and cooling, and the manufacture of cheese, butter and dried and condensed milk. Economic aspects concern the most profitable method of running a dairy farm and the marketing of milk and its products. Modern developments have introduced a whole host of new problems, including creamery management, large-scale dairy engineering, whey utilisation, silage making and grass drying, the scientific testing of milk and milk products and the scientific control of manufacturing processes.

# MILK PRODUCTION

## Dairy Farming

The primary function of a farm from the farmer's point of view, as of any other business concern, is to run at a profit. Many farmers are not really business men, and it is possible for a man to be a good farmer but a poor business man. It is noteworthy that the outstanding examples of " successful farmers " are first-class business men. The knowledge of what and how much to buy, how to buy machinery to the best advantage, and of what market to farm for is at least as important as a knowledge of crops and animals. To run a farm " as father ran it " may fail because the son farms under different conditions, and the differences observable between such farms and those where the farmer's son has had the benefit of a modern training and the best experience can be most striking.

English dairying is largely seasonal in the sense that nearly twice as much milk is produced in summer as in winter. This is clearly shown by the extensive manufacture of butter and cheese in summer,[1] and now, under war-time conditions, by the winter " rationing " and the supplementing of our supplies by condensed and dried milk. This state of affairs is due to the fact that grass is the mainstay of the dairy cow. To the urban citizen grass may be something to play golf on, but it is easily our most important crop, although it is not commonly thought of as such. An eminent authority on the subject has stated that our grassland could be increased in efficiency by 100 per cent. by proper treatment and fertilisation and the proper selection of grasses.[2] The ploughing-up and resowing of old and worn-out pastures can produce most striking results.

## Resting the Land

Keeping land down to grass results in a storage of fertility due to the animal excreta, and this can be most effectively utilised by a system of alternate husbandry in which the land is put to the plough for a period of 4 to 7 years after a similar period of grass. Besides " resting " the land, such a system has the further advantage that bacteria and other organisms that are harmful to animals and which may tend to become thickly populated in grassland, will die out when the land is used for cropping under the plough, and similarly when arable land is laid down to grass, micro-organisms and fungi that are pathogenic for crops will die out in grassland.

Controlled grazing is also a measure that can be employed to maintain a better balance between desirable grasses and poorer grasses and weeds.

A common cause of inefficient feeding was the overfeeding of concentrates. Thus it has been shown that the old figure of 0·6 lb. protein per gallon milk production is unnecessarily high and can be reduced to 0·45 lb. without a fall in the quantity or quality of the milk and without any appreciable falling-off in the condition of the cow.[3]

## Inefficient Cows

Keeping inefficient cows is a common cause of loss to the dairy farmer. It is surprising how few farmers record their animals' milk production or know their ability to convert feeding stuffs to milk. Far too much attention is paid to the " looks " of the cow, and most farmers have their favourite animals, which they are loath to lose. It is, however, far more important to know if the cow is suffering from mastitis and its efficiency as a milk-producing machine. Cows are frequently bought on quite casual inspection and " summed up " on appearances. Similarly breeding is sometimes haphazard. A bull may be bought for what may be described as personal reasons. Here again it is far more important for the purchaser to know the milk and butterfat production of its daughters and sires' daughters rather than to have a " fine animal ".

## Quality Aspects of Milk

One of the biggest curses of the dairy industry is the " gallon complex ". The total number of gallons of milk produced or sent away is usually the whole story as far as the farmer or creamery manager is concerned. Little thought is given to quality, chemical or bacteriological, unless some definite factor requires it. Thus butter creameries naturally keep a close eye on butterfat content and all milk depots become anxious in hot weather because of the danger of " sours ", especially in tanks which may hold 2,000 gallons.

The low solids in milk this year is the cause of much concern to most creameries, especially those making cheese, many of whom are reporting a cheese yield below 1 lb. per gallon, even with Cheshires. The cause has popularly been attributed to the lack of feeding stuffs and poor grass, but all the available evidence suggests that this cannot be a cause of low solids; shortage of food leads to a loss in yield but not in quality. The most common cause of low solids, especially solids-not-fat is mastitis,[4, 5] which is reputed to be more extensive in some districts this year, although the writer knows of no satisfactory evidence for this assertion. It has been estimated that animals could be tested twice a year at a cost of 6s. each if a national scheme were to be put into operation.[6] In addition to mastitis, watering is also more in evidence, especially in winter. Thus 3 per cent. added water, which is barely detectable, will reduce a S.N.F. of 8·6 per cent. to nearly 8·3 per cent. and 3·4 per cent. fat to 3·3 per cent. More serious is the loss in fat due to skimming the evening milk or withholding the strippings. This may easily reduce the fat from 3·4 per cent. to under the legal limit. It is evident that mastitis, skimming and watering result in a milk of decreased nutritive value—an evil that cannot be counteracted so long as milk is bought on a gallonage basis.

## Losses of Milk

Losses due to souring and other taints are chiefly a hot-weather worry. During the hot spell this year most creameries rejected 5 to 10 per cent. of their supplies on the platform, and cases are known where as much as 20 per cent. was returned. On the average in summer, rejects amount to 1 to 2 per cent., although practically all managers say that they would like to reject more, but fear to offend the farmers and lose their contracts.

Over the whole year it is probable that at least 0·2 per cent. and possibly up to 0·5 per cent. is rejected for one reason or another. If we include losses in the consumers' household, which are enormous in hot weather, it is safe to say that an average loss of 1 per cent. is incurred, corresponding to a cash value at present of nearly £1,000,000, and representing enough milk to give 250,000 children 1 pint every day in the year.

Losses due to taints in the milk do not stop at this point. For every gallon rejected there are at least 10 gallons accepted that are inferior in hygienic quality and are the direct cause of low-grade cheese and butter.

Soured milk as such is not wholly wasted, of course, as farmers feed it to livestock. From the point of view of human nutrition, however, it is for all practical purposes wasted. A further point that is more serious than is realised is that returned " sours " mean a dirty churn for the next load of fresh milk since the churn does not get cleaned at the creamery.

## Inefficiency in Collection and Transport

Some of the instances of this important aspect are so incredible that they would be ludicrous were they not so tragic. The fundamental principle to be observed in milk collection is to get the milk into an efficient creamery and cooled, or pasteurised and cooled as soon as possible. It is unfortunate that the peak of milk production occurs about the same time as the warmest weather of the year. Not only may churns of warm (uncooled) milk be left on the roadside in the blazing sun for several hours, but, when collected, churns are usually still exposed to the sun on uncovered lorries, which may have to wait in a collecting yard for two or three hours. The provision of covered churn stands on the roadside is an urgent matter, and a standard specification should be drawn up and farmers assisted to procure such stands. All lorries should be covered, and if the reception facilities (deck hands, platform space and weighing machines) are insufficient they should be increased. This is a difficult matter nowadays, but could have been done in the year before the war if the industry had been properly organised.

It is naturally desirable that milk should be cooled on the farm, but many farms in outlying districts do not have the necessary water at their disposal. Moreover, a dirty cooler may do more harm than good. Provided that milk can be cooled at the creamery within four hours of production and the utensils are sterilised, it is possible to produce good milk without cooling on the farm. The water situation on dairy farms is nevertheless a matter of urgent national importance and should be the subject of a proper enquiry immediately.

A further example of inefficiency and lack of central co-ordination is the roundabout journeys taken by some milks. Thus in some cases milk is handled three times by different creameries before being despatched to a large consuming centre, and in other cases milk collected from the region of a creamery A is cooled, or pasteurised and cooled, at B, and then sent back to A or to a place in A's district. The distance from A to B may be 30 or 40 miles. It is not surprising that severe losses have occurred through souring of bulk milks, and there is an urgent need for instruction of creamery personnel in the essentials of milk handling. All unnecessary handling should be eliminated and the travel of milk reduced to a minimum. This has now largely been achieved by rationalisation of collection and transport. A further improvement would be rationalisation of creameries—*e.g.*, having one big creamery in an area instead of two or more small creameries—and so distributing collecting centres that milk does not have to travel more than 10 miles. Milk that is properly pasteurised and properly cooled (to less than 40° F.) and is protected from recontamination has amazingly long keeping qualities,[7] but it seems rather surprising that we should expect dirty raw milk improperly cooled to get to London from distant places in hot weather without souring. All milk that is collected in far regions and is destined for London, for example, should be treated by the high-temperature—short-time method at 150° to 155° F. for 15 seconds, cooled to below 40° F., sent to London and there properly pasteurised (145° F. for 30 minutes or 162° to 164° F. for 15 seconds).

## Rationalisation of Distribution

Many suggestions on this point have already been put forward. Once-daily deliveries should entail no difficulties for the housewife, who can always fall back on tinned milk in an emergency. The competition between retailers is a more difficult matter. An arrangement such as that suggested in the Perry Report (competition limited to the Co-operative Society and a pooled other-retailer combine) is not acceptable in all circles. An alternative plan would be the proper geographical allocation of retail dairies in towns and service to a defined area around the dairy-retailer's allocation. This does, however, remove the competitive element which is so desirable in all activities, although it is doubtful whether the average housewife knows enough about milk to argue on the quality aspect with the milkman, who usually employs the stock excuses when the milk is tainted or is unsatisfactory for any other reason.

## The Problem of the Small Retailer

The chief problem in milk distribution, as in other aspects of the dairy industry, is the small man. Normally, anyone can buy a few cows and pose as a dairy farmer or can buy a few gallons daily from a farmer and become a milk retailer. The producer-retailer occupies a unique position in the industry, but although accounting for some 35 per cent. of the total number of producers (50,000 of 150,000), the producer-retailer handles slightly under 20 per cent. of the total supply by volume. (Many producer-retailers also sell milk on wholesale contracts.) There is a certain idealistic aspect in the farmer selling the milk of his own cows that appeals to the public, and there is no doubt that some of our best milk comes from this source. We must, nevertheless, recognise that there is a definite trend in all industries to large-scale working. In other words, the small producer-retailer, dairyman, butter-and-cheese-maker is doomed to extinction in the sense that only the best will survive. This is inevitable in view of the growth of scientific control of technical processes—the small man cannot compete with the large firm. This trend does not hold for dairy farming, however. While the 2- or 3-cow man frequently produces very poor quality milk, the " dairy farming " being a part-time occupation, the smallholder with 10 to 20 cows often produces first quality milk, and could do so always with help on such problems as mastitis. The family is an ideal unit for running the dairy smallholding, and success in milk production is largely due to the farmer's wife, who is usually responsible for the care of utensils. Summing up, therefore, the trend will be towards large creameries and dairy farms with herds of at least 10 cows. The most difficult administration problem is the treatment and marketing of the milk produced by farmers not selling to creameries, especially those in rural areas. In the interest of efficiency and public health it is advisable to collect all this milk at a central depot in each town or village and efficiently pasteurise and cool it. The only exception to this scheme would be the farms producing tuberculin-tested milk. It is not right that any one should be able to sell milk of uncertain quality to the public and the obvious financial advantages of producer-retailing should be a reward limited to the man who has put himself out to sell only the best quality milk.

## Manufacturing Processes

The change over from small-scale farmhouse manufacture to large-scale creamery production has been very rapid in the last decade. For example creameries accounted for only about 40 per cent. of the cheese made in this country in 1930; they now account for about 70 per cent. Large-scale working has inevitably radically changed manufacturing procedures, and the transformation has been too fast for the industry, which is suffering from a lack of adequately trained technical staff adapted to deal with creamery conditions. Independent testing of milk supplies and independent grading of milk products are measures that are badly required in the industry. The war has resulted in the latter for cheese, and it is to be sincerely hoped that this grading will extend to all products after the war. The incentive to better cheesemaking as the result of the price differentiation between grades of cheese has been most noticeable, and is interesting as an example of the beneficial effect of quality payment.

## Public Health Aspects

We now deal with one of the most controversial subjects of modern times. The question of compulsory pasteurisation has been bitterly debated by the agricultural community and the medical profession. Unfortunately bigots are to be found on both sides. Many medical men refuse to recommend milk unless it is boiled first, and most people dislike boiled milk. The medical profession rightly points out, however, that some 40 per cent. of dairy cows may be infected with T.B., although the distinction between infected cows and cows excreting T.B. is not always made clear. The latter is of the order of 0·1 per cent. It must be admitted, however, that two or three thousand people die every year from T.B. of bovine origin. In addition, some medical officers believe that undulant fever (*brucellosis*), a disease caused by bacteria in milk which are closely related to the organisms of contagious bovine abortion, is much more widespread than is generally realised, fatalities being rare and diagnosis difficult. The "raw milk scare" is also kept alive by the periodic outbreak of "carrier diseases" in epidemic form, such as the typhoid, paratyphoid, scarlet fever and septic sore throat outbreaks.

## Opposition to Pasteurisation

Opposition to pasteurisation over the period 1925-1935 was largely based on prejudice, claims that pasteurisation seriously affected the nutritive value of milk, and the fear that universal pasteurisation would kill the campaign for a clean milk supply. It is time, however, that we stopped talking nonsense about pasteurisation and attempted to make an impartial examination of the facts. Instead of asserting, "We don't *believe* in——" we should ask, "What is the scientific evidence on this matter?" The evidence is that pasteurisation has no measurable effect on any of the major constituents of milk.[8] The chief loss is in vitamin C., and this can be minimised by proper control and exclusion of light. Losses in $B_1$ are very slight and in other vitamins negligible. It is, moreover, now universally accepted that pasteurisation cannot make dirty milk clean, and that serious troubles can occur in pasteurised milk if the raw milk supply is dirty or infected with certain types of heat-resistant bacteria. Insistence on pasteurisation should not therefore result in a loss in enthusiasm for a cleaner milk supply.

Efficient pasteurisation kills all pathogenic organisms of any significance in milk; the presence of pathogens in pasteurised milk is due to post-pasteurisation contamination. It is of interest to note that there may be more T.B., for example, in pasteurised milk than in T.T. milk. Neither pasteurisation nor tuberculin testing can be guaranteed to eliminate T.B. entirely from milk; there is always the human factor and nothing is 100 per cent. in biology!

## All Milk other than T.T. should be Pasteurised

A reasonable conclusion from a consideration of these facts is that all milk other than T.T. should be pasteurised. It is essential, however, for all pasteurisation to be properly controlled, and steps taken to make post-pasteurisation contamination impossible. The ideal to be aimed at is "in-bottle pasteurisation" for all milk destined for liquid sale, while the high temperature-short-time process might become the standard method for all milk destined for manufacture. A scheme whereby the public would be able to have the choice of raw T.T. or pasteurised milk at the same price, while the T.T. producer would receive an adequate payment for the extra expense, would leave a market for raw milk, safeguard the public health and avoid the universal compulsion of pasteurisation which is so distasteful to some people.

## The Industry and the Community

Hitherto discussions on changes in the structure of the dairy industry by individuals have usually been based on the thought, "What can my particular section of the industry get out of it?" Let us now attempt to approach the problem on a fundamental basis. This can only be done by sweeping aside the self-interest of the individual and asking ourselves, "What does the community require from the industry?" Reduced to its simplest terms, it is the provision of an adequate supply of safe, clean milk for the whole community. If we take this at 1 pint per person per day it amounts to 1,800 million gallons per year for England and Wales. In 1938-39 some 1,080 million gallons were sold at a wholesale value of £52 million, and of this about 250 million gallons (*i.e.*, one quarter) were manufactured into butter, cheese, cream, etc. Now it is obvious from all points of view that the most efficient way of getting our butter and cheese is to import it. The freightage per lb. of nutrient is very small, and the higher the proportion of milk products imported the more liquid available for consumption and the higher the national pool price. Further, the more of our milk consumed as liquid the less the loss due to the feeding of whey and skim to animals. However, the higher production in summer, which is nearly twice that in winter, would at present necessitate the manufacture of cheese, etc., in summer and the importation of dried milk for winter use, which really amounts to the same thing. Alternatively, surplus milk could be dried in summer for winter use, dried milk having almost the same nutritional value as liquid milk.[9] Ultimately, however, we might hope that the efficient use of grassland, coupled with scientific methods of conserving the grass, such as drying and silage making, would almost level out summer and winter production. However the internal distribution is arranged, we should aim at a national production of 1,800 million gallons, which means practically a doubling of our present production. All other considerations should take second place to this.

We can now discuss concrete proposals for reforms in the industry.

1. *The necessity for one central authority.*

There is little doubt that the most important improvement that could be effected would be the establishment of one central authority—a Milk Industry Commission (M.I.C.) that would function like other public corporations. The present state of affairs can only be described as chaos. Milk is controlled directly or indirectly by a number of authorities—the Ministries of Health, Agriculture and Food, the Milk Marketing Board, the National Farmers' Union, local authorities which exert an influence through various channels which do not always work smoothly in harness, the medical, scientific and veterinary professions, and finally the individual buyers and sellers of milk. Some of these have very little real knowledge of milk and exert an enormous power, others pursue a definite policy of doing nothing and seeing that nobody else does anything, others have a considerable knowledge of the problems of the industry but seem afraid to do anything. One important factor is the fact that most divisions of the industry at present work in watertight compartments. Very few persons inside know much about other aspects of the industry, and the most distressing feature is the gap between practice on the farm and in the creamery and modern scientific knowledge. There is a great need for co-ordination of research, teaching and practice. Attempts have already been made to establish such a Commission, and the withdrawal of the 1938 Milk Bill has been regarded by many persons of eminence in dairying as the most unfortunate happening in the history of British dairying.

How should such a Commission be formed? It is obvious that it must represent all aspects of the industry and the following structure is suggested:

| | |
|---|---|
| Government | Ministry of Agriculture |
| | ,, ,, Food |
| | ,, ,, Health |
| Commercial | National Farmers' Union |
| | Wholesale Dairymen |
| | Retail Dairymen |
| | Manufacturers |
| Technical | Dairy Research |
| | ,, Education |
| | Marketing |
| | The Consumer |

(*Continued on page 262*)

# PLANT AND EQUIPMENT FOR THE FOOD INDUSTRY

## High-Temperature Short-Time Pasteurisation

ONE of the most interesting developments in plant engineering, as far as the dairy trade is concerned, which has taken place during the year is the adoption of short-time pasteurisation by many dairy companies.

This system has also recently received official recognition by the Ministry of Health by the publication of a Provisional Order on July 9, and it is likely that an even greater number of operating companies will change over to this system.

Pasteurisation is essentially a time-temperature treatment, and while the temperature of 145° F. and time of 30 minutes has been adopted in this country for many years, there are obviously many other combinations which could be used, and one which has been used to quite a large extent in the past few years, both on the Continent and in America, is a temperature between 160° and 162° F. with a holding period of between 12 and 20 seconds.

Recent experience has shown that the operation of a low-temperature holding plant has presented many difficulties under war conditions, not the least among which concern the shortage of labour and, particularly of skilled labour, the additional cleaning which is required for the holding tanks and the difficulties which are experienced when operating a holding system under air-raid and black-out conditions.

Many of these objections do not apply, or only in a very limited degree, to the short-time pasteurisation process, and it is principally these factors which have led the dairymen to consider it favourably.

Over thirty dairies will have been equipped with short-time pasteurising equipment by the end of the summer, and it is anticipated that nearer seventy will be operating on that system before the end of the year.

One of the important qualifications in using the process is that the plant must be automatically protected from the risk of under-heated milk passing through the holder and coolers to bottle-filling machines. This necessity has given rise to great ingenuity in design, and several such flow diversion valves have been produced both in America and in this country.

A brochure describing the process in further detail is now obtainable from the Aluminium Plant and Vessel Company, Ltd.

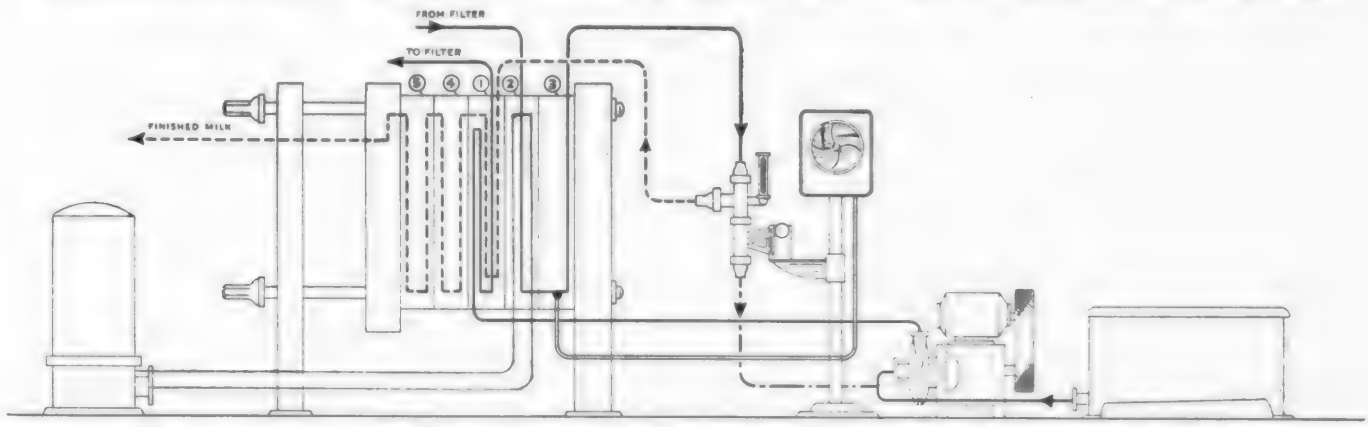
## Control of H.T.S.T. Pasteurisation

With the new high temperature short-time method of milk pasteurising which has now been legalised in this country certain revisions of ideas on the application of automatic control apparatus must be made. The essential feature which must be borne in mind with this new method is the highest possible speed of response and steady control of all possible variables.

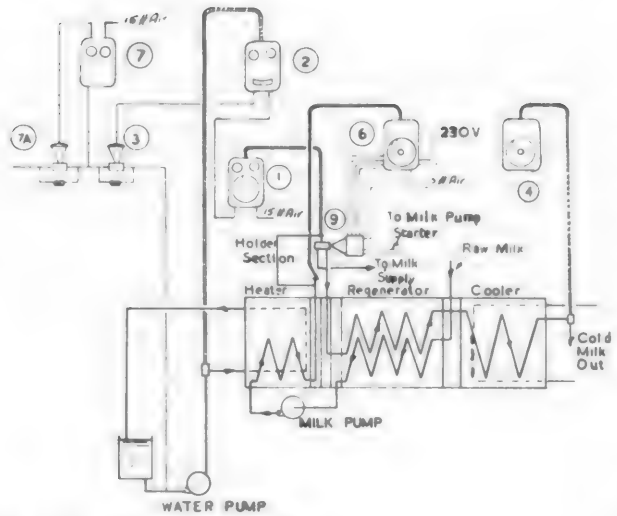
In order to obtain high speed of response on the temperature control side it is necessary to use a vapour pressure system of temperature measurement and control operation. The vapour pressure system of temperature measurement has a speed of response many times greater than that of any other known commercial method other than the pyrometric, which, generally speaking, is too costly for the average dairy installation. Another important feature obtained with the vapour pressure system is that a large-scale range can be obtained which fully covers sterilising temperatures and yet, due to the expanding scale, gives large temperature divisions greater than $\frac{1}{8}$ inch wide at the critical pasteurising temperature.

The generally accepted method of applying the recording and controlling instruments to H.T.S.T. pasteurising plant is shown in the accompanying sketch. Item 1 is an air-operated non-indicating pressure control maintaining, by means of the diaphragm-operated control valve 7A, a supply of steam at constant pressure to the pasteuriser. Item 2 can be either an indicating or non-indicating non-recording air-operated hot-water temperature controller which, by means of the diaphragm-operated steam valve 3, maintains a constant hot-water temperature to the milk heater. The hot-milk controller, item 1, is an air-operated recording controller using the free vane principle of proportional throttling control which, in conjunction with the hot-water controller 2, and the control valve 3, maintains a constant milk outlet temperature from the heater. This instrument is in effect a supervisory control and takes care of any variations in rate of milk flow or incoming raw milk temperature.

The thermal limit recording controller, item 6, is an extremely sensitive and accurate recording thermometer, giving a permanent continuous record of the hot-milk temperature coming from the heater before the holder section. The object of putting the temperature-sensitive bulb of this instrument before the holder section is as follows. Any thermal limit controller, no matter how designed, is bound to have some thermal time delay, and in order to ensure that no sub-legal temperature milk is passed through in the forward flow direction before the flow diversion valve operates it would be necessary, if the temperature-sensitive bulb is after the holder section, to have a section of milk pipe between that bulb and the flow diversion valve, the length of which is such that the time taken for the milk to flow from the bulb to the valve is slightly in excess of the




**Typical Flow Diagram of High-Temperature Short-Time Pasteurisation.**




**H.T.S.T. Pasteurisation Control.**
*(Bristol's Instrument Company, Ltd.)*

thermal delay of the instrument. However, with the temperature-sensitive bulb before the holder section, that extra length of milk pipe is not necessary and there is, therefore, no possibility of partially holding the milk after the holder section, with the consequent deterioration of milk quality. This recording thermal limit controller is fitted with electric control contacts, which immediately operate the flow diversion valve 9 should the hot-milk temperature drop below the legal limit. Immediately the flow-diversion valve comes into operation the hot milk is diverted from the heater back to the raw milk supply, so that no sub-legal temperature milk is passed through to the bottling machine. The flow-diversion valve does not come back to forward flow position until the milk temperature has risen to the required legal temperature.

The flow-diversion valve is electro-pneumatically operated to give instantaneous diversion, and is provided with a fail-safe feature which prevents the milk flowing in the forward direction should either the air supply or power supply fail. This valve has a specially constructed hygienic valve body which can easily be dismantled and cleaned by the dairy operator.

The hot-water controller, item 2, the hot-milk controller, item 1, and the thermal limit controller, item 6, are all vapour-pressure type instruments which give instantaneous response to the slightest temperature change and so maintain temperatures well within the required close limits.

## Apparatus for Colour Control

Apparatus for colour control may be divided into two main sections—(*a*) instruments performing true colour measurement, especially trichromatic; (*b*) instruments which more or less accurately measure the selective transmission or reflection of light throughout the spectrum (spectrophotometry).

The principal representative of the former class now produced in this country is the Donaldson Trichromatic Colorimeter, which has generally superseded its forerunner, the Guild Trichromatic Colorimeter. It measures colours by comparing them with a colour synthesised by the admixture of controlled quantities of radiations transmitted by three carefully chosen filters. The instrument is so constructed that its readings may immediately be stated in terms of the internationally accepted C.I.E. system of colour measurement.

Measurements in the second section are usually stated in terms of density $\left(\log \frac{\text{incident light}}{\text{transmitted light}}\right)$ at selected wavelengths, which, in Abridged Spectrophotometers are isolated by colour filters and in Precise Spectrophotometers are selected by means of a spectrometer or monochromator, and plotted on a curve.

One of the simplest abridged spectrophotometers is the Hilger Photometric Colour Comparator, in which a sliding plate with colour filters fitted to the eyepiece serves to select portions of the spectrum at which measurement of the density is made by means of a polarising system. This instrument is designed for use, when necessary, with a Photometric Colour Amplifier, which, by securing multiple reflections in a hollow cylindrical specimen, increases the effect of their selective absorption. In this way nearly white substances, such as flours, can be examined.

The colour of transparent solutions may be assessed photoelectrically by means of the Hilger Spekker Photoelectric Absorptiometer, whose principal function is that of a photoelectric "colorimeter" for use in colorimetric methods of chemical and bio-chemical analyses. In this instrument colour filters are used to select the spectral regions of measurement, and a null circuit photoelectric device indicates the correct setting of an adjustable measuring shutter controlled by a large drum engraved in densities.

Such measurements are of very great interest in commercial work, involving problems of discoloration, but for research work, where small variations of absorption at definite wavelengths may be significant, a precise spectrophotometer such as the Hilger Research and Industrial Spectrophotometer is required.

Another instrument, the Blancometer, a photoelectric instrument, is entirely independent of visual colour discrimination, which enables nearly white colours to be measured in the C.I.E. system with an accuracy far in advance of that attainable by visual means.

## *p*H Instruments

The Cambridge Instrument Co., Ltd., are well known for their range of *p*H instruments, and have recently published a booklet entitled *Cambridge* p*H Instruments*, which describes the different modifications of these.

This booklet hardly comes under the category of an ordinary industrial catalogue, but actually forms a concise textbook on *p*H measurements, which provides a simple and clear account of the subject sufficient for the majority of users.

For those whose interest is such that they desire to study more completely the applications in any particular branch of industry or science a comprehensive bibliography is included. This bibliography is not a simple list of the literature, but is arranged in alphabetical order under the different industries, and the manner in which *p*H measurements are used in each industry is described. Some of the applications covered are preserved foods, sugar manufacture, water, sewage, trade effluents and scrubber liquors, glue and gelatine manufacture, flour milling and baking, chemical analysis, corrosion of metals, dairy industry, electro-deposition of metals, pharmacology and pharmaceutics. The references to the literature give recent outstanding articles and papers on the subjects.

Photometric Colour Comparator with Photometric Colour Amplifier.

### Electrical Distance Thermometers

Many modifications have been incorporated and some new illustrations are included in a new reprint of a list recently issued by Elliott Brothers (London), Ltd., showing the latest developments in these instruments. A number of photographs showing recent applications of these instruments have also been added to this edition.

There is a description of the Bridge Cross Coil System which is used particularly when the source of current supply is the mains, which are subject to voltage variations, and the Null System, which gives the highest degree of accuracy and sensitivity. This latter instrument was designed as a result of researches at the Cambridge Low Temperature Station of the Food Investigation Board.

These instruments are particularly applicable at the present time in connection with cold stores, grain elevators, food manufacture and processing, and also for chemical works, heating, ventilating and air-conditioning plants, etc.

### Time Recorder for Night Watchmen

The present compulsory system of fire watchers for all kinds of works, factories, business premises, offices, etc., has introduced a new problem in control of personnel.

In large works it is necessary for watchers to maintain a constant patrol covering every part of the premises, and a time schedule should be drawn up stating the times that various points must be visited.

Fire watching is an important job, and unless it is carried out in a proper and systematic manner the benefits will be lost. In addition to the war risks of incendiary and high explosive bombs, there are the ordinary risks of smouldering rubbish, faulty stoves, burst steam or water pipes, short-circuiting of electric wires, damage by gale or rain due to open windows, etc.

Constant vigilance is therefore absolutely necessary, and to ensure that any time schedule of patrol is followed it is essential to have some method of control.

The Watchman's Time Clock, made by Servis Recorders, Ltd., is a simple instrument which can be fitted almost anywhere. The watchman only has to move a lever on the instrument and the time of his visit is then recorded on a chart.

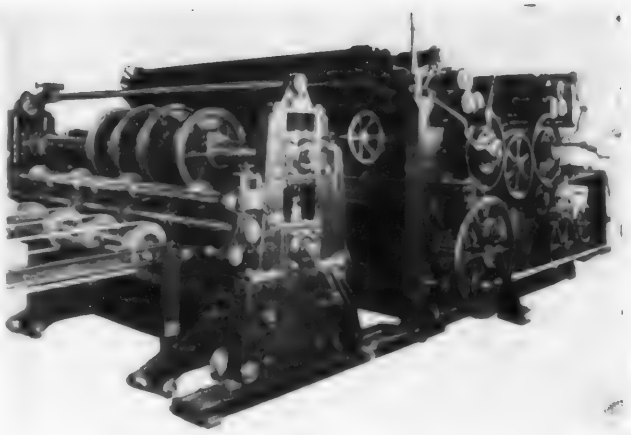
### Teak for Laboratory Floors, Etc.

In planning the construction and equipment of laboratories and workshops the outstanding qualities and great versatility of teak should be borne well in mind. In comparison with other commercial timbers teak possesses very high powers of resistance to the attack of both inorganic substances (*e.g.*, acids and other chemicals) and living organisms (*e.g.*, insects and fungi). It is unaffected by unlimited wetting and drying and is exceptionally steady under changes of atmospheric temperature and humidity. These qualities make it the most hygienic, durable and satisfactory of materials for flooring, benches, test tube and other apparatus holders, cupboards and shelves for chemicals, etc., as well as for a great variety of vats, troughs, sinks, bowls, etc.

Teak is hard and strong, though not unduly difficult to work, and is very pleasing in appearance. It should be remembered that there is only one true teak, the species *Tectona grandis*. The name teak has often been pirated in order to assist the sale of timbers of other species, but none of these can be relied upon to behave as teak behaves. Care should therefore be exercised to obtain the genuine timber. The great source of true teak to-day is an Empire country—Burma. The supplies in this country are in the hands of the Timber Control and are released under licence for approved purposes. Its cost is not excessive—the fixed prices are given in Timber Control Order No. 18 of June, 1940. In fact, as it needs no preservative treatment of any sort and practically never gives any trouble in service, however severe the conditions, it is relatively a cheap timber.

### Rotary Cutting and Printing Machines

The widespread use of automatic machinery for packing branded goods (particularly in the food and associated industries) has given rise to the need for cartons, etc., which present a first-class appearance and which are, in addition,



accurate and consistent in size and shape to the fine degree necessary to ensure efficiency of the packing plant.

With this object in mind, the Thrissell Engineering Co., Ltd., has developed their reel-fed rotary cutting and printing machines, with the result that machines and equipment are available for the economical production of cartons, wrappers, labels, etc., which can be cut, creased and printed in one operation with any number of colours and by combination of processes to suit the job in question.

For instance, the "Thrissell Simplex" machine (which is manufactured in six different sizes) is normally equipped with either direct letterpress or letterpress offset printing heads, but additional aniline or gravure units may be incorporated. In the same way, the "Thrissell Aniline" and "Thrissell Gravure" machines can be equipped with either direct letterpress or letterpress offset printing heads.

The use of gravure is particularly interesting as it enables metallic inks to be printed with the absolute certainty that the product will have no metallic powder lying on its surface. The fact that this process uses a spirit ink which dries almost instantaneously also makes it possible to print either colours or metallic inks on non-absorbent materials such as glascine, cellophane, etc., without fear of "set-off" or smudging the result.

### Glass Pipelines

Largely to the method of manufacture of the flanged ends, enabling a precision job to be made of the joining, may be ascribed the success of the "Pyrex" Brand Glass Pipeline. This standardisation not only greatly facilitates replacements but also makes for a pipeline able to withstand far greater pressures than can be obtained by other means.

The advantages of such a pipeline, quite apart from the obvious one of being able to see what is happening to the products, are the ease with which the pipe can be sterilised and cleaned, and the fact that the pipes can operate under pressures which, though not comparable with stainless steel, are greatly superior to that obtained by other methods of joining. This ability to withstand pressures up to 30 lbs. on the square inch will be obvious in such things as carbonated beverages, etc., and will also enable the pipe to withstand the pressures necessary, whether operating under a pumping system or with a considerable head of liquid.

Many accessories in the way of T pieces, U bends, etc., can be obtained for these pipelines, and the price of the lines compares very favourably indeed with that of stainless steel.

### Spray Painting Guns

Designed for work where speed of coverage combined with economy in materials is of first importance, Model DX Spray Painting Gun by B.E.N. Patents, Ltd., utilises high pressure for atomisation and low pressure for distribution, which results in the absence of spray fogging and an exceptionally smooth finish.

Constructionally it is robust and attractive. The body consists of a heavily nickel plated, highly polished, bronze forging, whilst the material needle is of stainless steel. All parts are machined to precision limits and are interchangeable. The lower part of the handle is equipped with a convenient screw-down cock for draining off the condensed

moisture which might otherwise ruin high-class work. Positioned between air hose and gun the cock is situated where it can be used to best advantage.

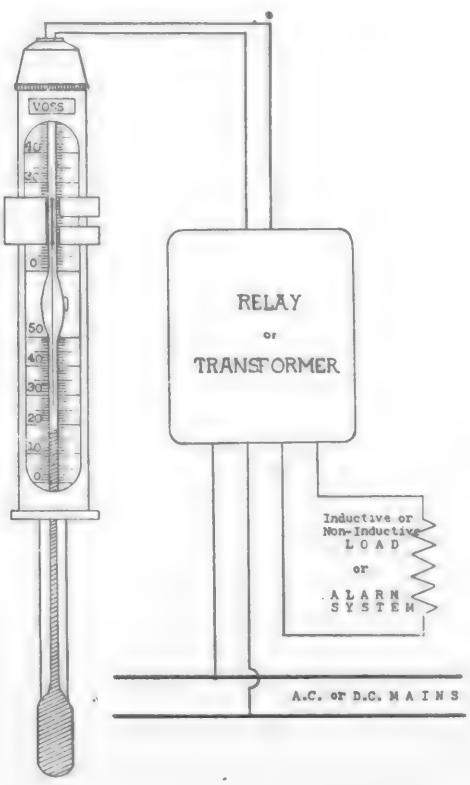
The gun is supplied in two types—Models DXC and DXP—for use with syphon cup and with pressure or gravity feed containers respectively. Both types are available with a range of round or fan spray heads utilising 2, 3½ or 5 cu. ft. of air per minute. With the fan head the width of the spray can be regulated by the material adjusting screw and a vertical or horizontal spray obtained by a half-turn of the spray head.

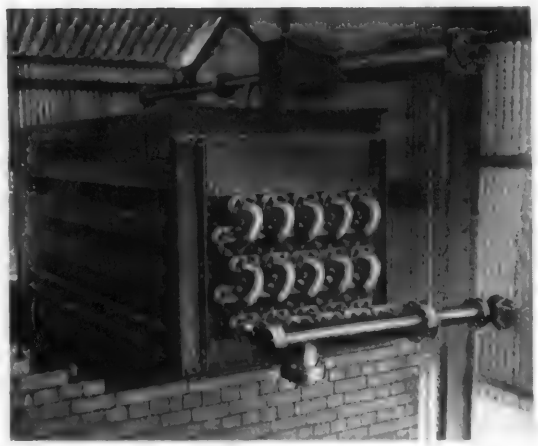
## Transportable Sterilising Plant

In connection with the sterilisation by chlorine gas of the very large amount of washing water used in the food industries, especially canning and bottling, it is a decided advantage in these days of air-raid damage to be able to use equipment that can be easily transported from one place to another. Consequently, interest attaches to the special transportable "Chloronome" equipment supplied by the Paterson Engineering Co., Ltd., one of the range of their different types available.

This embodies the "B.C.M." panel type of machine, which is fixed on a steel frame stand carried on a four-wheel steel base, which also takes, in neat fashion, a chlorine cylinder fixed vertically at the back of the panel, the latter having at the front also the chlorine glass injector device for passing a relatively strong solution of chlorine in water into the bulk supply being sterilised. The whole arrangement can be pushed over a smooth hard floor or carried by means of two stout poles passing through metal rings on either side of the steel stand. There is also provided a separate small and compact self-contained portable direct-coupled petrol engine driven centrifugal booster pump set, carried in a similar manner on a steel base with wheels.

When it is necessary to sterilise water flowing in a closed pipe, for example, the latter is tapped at two points and special screw connections inserted for the use of flexible metal tubing. By this means the pump takes a small amount of water from the main, pumps it through the injector portion of the chlorinating apparatus to which the desired measured trace of chlorine gas is passed continuously, the chlorine solution then passing back into the pipe, giving rapid and uniform sterilisation.



Economiser installed at a colliery in South Wales working in conjunction with a Lancashire Boiler having a normal evaporation of 8,000 lbs. per hour.

## Economisers

The installation of an economiser can at all times be looked upon as a profitable investment as the fuel saving results from the recovery of heat in the products of combustion, which heat would otherwise pass to waste. Economy in fuel consumption was never more important than at the present time when the nation's needs demand that all waste should be eliminated, and one sure way of achieving this object is by the adoption of economisers, which have in the past been the means of saving millions upon millions of tons of coal.

The economiser shown in the illustration is installed at a well-known colliery in South Wales, and is of the latest "Premier Diamond" construction manufactured by E. Green and Son, Ltd., pioneers of the economiser industry. It consists of twenty-five horizontal gilled tubes 12 feet long, arranged five tubes wide, five tubes high, and is working in conjunction with a Lancashire boiler having a normal evaporation of 8,000 lbs. per hour. The economiser was designed to give a rise in feed water temperature of 180° F., representing a fuel saving of approximately 16 per cent.

The tubes of the economiser are of diamond shape in vertical cross-section, fitted with rectangular gills and possessing high heat transfer properties. It is thus possible to provide maximum heating surface in a minimum of space.

One of its exclusive features is that it complies in all respects with the requirements of the Factories Act of 1937 in that all parts of the tubes can be inspected internally and externally without removing any of the elements. It can be applied to all types of boilers and is suitable for operating at all pressures.

## Automatic Temperature Control

In essence an automatic thermally operated electric switch which will maintain temperatures with a fine degree of accuracy, the Voss Adjustable Contact Thermometer is of the enclosed scale type. Two scales are provided—the upper one for adjusting and setting the movable index to any temperature desired and the lower one for measuring temperature.

Adjustment is made by means of a collar-shaped magnet sliding over the thermometer which at the same time holds the index in position once it has been set to the desired temperature. A fine wire extends from the index into the lower capillary. When the mercury rises it touches the lower end of the contact wire, thus closing the circuit, bringing into action a suitable relay which in turn will operate any other piece of apparatus in the same circuit. As soon as the mercury falls, the circuit is opened again. Very fine temperature control is thus guaranteed.

Contact thermometers cannot be connected straight to the mains and are normally operated through a relay or switch unit. Relays can be obtained either for closing or opening the circuit.

# NICOLAS APPERT
## 1752—1841

**One hundred years ago died that modest and lovable genius, Nicolas Appert. This is a tribute to the man whose epitaph might be inscribed in any food-preserving factory—*Si monumentum quaeris, circumspice.***

M. SCHOFIELD, M.A.

IN DAYS when every tin of food on pantry shelf promises variety in our routine rations, the " tin " can will serve as ubiquitous reminder of Nicolas Appert, who died a century ago. It took one hundred years of inquiry and experiment to bring to perfection the commonplace can, yet success was only possible because of Appert's genius. Gay-Lussac praised his work, and so did Parmentier, that economist and physician to the Invalides who cultivated potatoes on the plain of Neuilly and convinced France of the value of them for food. As for Pasteur, who unlike Monsieur Appert got his reward from posterity, in publishing his methods of conserving wine while ignorant of Appert's work, he himself acknowledged that Appert was first in the field.

### First Steps in Preservation

Primitive man gorged himself in days of plenty, but had to grub along when his hunting proved unsuccessful and the seasons denied him other foods. No doubt he deemed it a great advance on discovering that strips of meat could be dried in the sun and stored in caves. Such a crude method of preserving was the first step in the fight against Nature's armies of bacteria and moulds. The Romans knew nothing of bacteriology, but they did know that salt was a first-rate preservative. Hence salt became a fundamental commodity, a symbol of incorruption, and the Roman soldiers received their ration of salt as part of their pay or " salary ".

### Early Investigators

Though smoking and pickling of foodstuffs were added later, none of these methods was universally applicable nor entirely satisfactory over long periods. No progress indeed was possible towards victory over natural processes of fermentation and decay until the nature and method of attack of bacteria and moulds were understood. Before coming to Appert, therefore, mention must be made of pioneers like Antoni van Leeuwenhoek, that draper's assistant of Delft who ground his own lenses, constructed a microscope, and with its aid first saw some larger forms of bacteria :

> *long and nimble, some spinning like a top, and others like a swarm of gnats.*

Then the Abbé Spallanzani, after keeping meat extract sealed for long periods in flasks and sterilising by heat, made a vital contribution when he banished the old theory of spontaneous generation of living spores.

### Versatile Appert

Nicolas Appert, born in 1752 at Chalons-sur-Marne, and the son of a wool-comber, worked and experimented with foods all his life. In storehouses for grocers, in kitchens, in the wine cellars of Champagne and elsewhere, this unassuming Frenchman worked as brewer, pickler, distiller and confectioner—apparently a jack-of-all-trades, *but* he became master of one. He had set up (after little education) as confectioner in Paris at a time when the Napoleonic wars demanded the preservation of foodstuffs in naval and military stores, the French Government offering a prize of 12,000 francs for an invention enabling such preservation to be made. Eight years previously the Royal Society of Arts in this country had offered 50 guineas to anyone inventing a method of " salting " foods so that flavour and freshness were unimpaired. Thomas Saddington was the only one to submit a suggestion worthy of consideration, and even he received only thirty guineas since his scheme was deemed unworthy of the full prize. His later idea of fruit bottling seems to have been copied from that of Appert. But Appert fully satisfied the conditions of the Minister of the Interior for the French award : " It has appeared to me, sir, that it is of moment to spread the knowledge of your processes for the conservation of animal and vegetable substances. I desire, then, that you write an exact and detailed description of these processes, this description that you deposit with the Consulting Bureau of Arts and Manufacturers, to be presented at your expense, after it has been examined and reviewed."

### The Art of Conserving

Appert's reply was that classic of 1810, which won for him the title of " Benefactor of Humanity ", his *Livre des tous les Menages, ou L'Art de Conserver, pendant plusieurs années, toutes les substances animals et végétales. Par Appert, Ancien Confiseur et Distillateur.* In it he showed the genius he was, with his infinite capacity for taking pains—" My theory is no theory; it is the fruit of my dreams, of my reflections, of my researches and of countless experiments." He was a true scientist who planned, observed, and then drew his conclusions. Since some foods heated in closed vessels remained edible, why should not others behave likewise? Bacteriology was unknown in his time, and the general belief in spontaneous generation of living spores had to be fought against. In his laboratory for preparing soups and fruit juices he selected his appropriate cooking vessel for each occasion, like one of Lewis Carroll's characters :

> *I took a kettle large and new*
> *Fit for the deed I had to do.*

He had his place for corking and wiring; his special bottles often with necks four inches across; his cork stoppers made with several layers with pores running horizontally to avoid too much access of air until sealing was accomplished. He put food in these bottles (specially made since the narrow-necked type were unsuitable), put the bottles in sacks for protection, heated them for six hours in boiling water to sterilise the contents, and then sealed them with layers of cork and wax. In 1804 a report to the marine prefect at Brest (a port much quieter then than now!) told how the provisions prepared by the process of *Le Citoyen Appert* and sent there were in sound conditions after three months on the road—the broth good, the beef very edible, and the beans and green peas, whether with or without meat, having all the freshness and savour of fresh vegetables. At a later date the Society for the Encouragement of National Industry was so impressed that Appert's results were tested far more searchingly in Government ships which took his preserved foods far south of the Equator into extreme climates. But all ships' captains made the same report of freshness.

### Increasing Activities

Though Appert had not hit upon the true scientific explanation of sterilising, he was not led into false generalisations as was that great chemist, Gay-Lussac, who was a member of the committee verifying Appert's experiments. In a memoir to the Institute, Gay-Lussac wrote : " Vegetable or animal substances, through their contact with air, acquire immediately a disposition to putrefaction or fermentation; but in exposing them to the temperature of boiling water in vessels well closed, the absorbed oxygen produces a new combination, which is no longer able to excite fermentation or putrefaction, when it becomes concrete by heat in the same way as albumen." Appert succeeded because he left scientific theory in other hands, and with the money granted him he set up the House of Appert in 1812, a house which has been flourishing ever since that date. He bought land at Massy, near Paris, for growing fruits and vegetables. He delivered meats, fish, eggs, game, milk and all foodstuffs ordered by the Government, and in one case won a further reward by sealing off 17 kilos of beef in a single container. (In 1852 another member of the House of Appert exhibited a whole sheep which had been cooked and sealed in a large can four months previously.) In all these increased activities Appert was successful because he was thorough, because he insisted on the utmost care in cleaning apparatus, utensils and foods to be used : " It is not necessary to recommend celerity and the strictest cleanliness in the preparation of foods," he

wrote in his classic, "they are indispensable, particularly for those that are to be preserved."

Although it was another Frenchman who introduced metal containers, he only did so after hearing of Appert's methods. Peter Durand hit upon the idea of a tinned iron container as more suitable for transport, and by 1817 the English firm of Donkin was supplying the Admiralty regularly with canned meat stores. Appert started using metal cans, but he had to make his own, for the usual quality in France was as inferior as the ubiquitous Portuguese sardine tin of today. He plated wrought iron after the can had been formed, and on request of ships' captains he made some rectangular ones as well as round and oval. Rectangular cans saved shipping space though more difficult to form, and so solid were all cans for marine use that not only could they be used repeatedly, but they were used as casseroles. Appert discovered a method of extracting gelatine from bones without the use of hydrochloric acid, and a method for melting and purifying fat for candles. Hence came his simple form of autoclave, a kind of Papin digester which he had to handle himself since his assistants were terrified by the escaping steam and by occasional accidents. Here, again, one of his relatives carried on the good work, for Raymond Chevallier-Appert introduced a patent autoclave with pressure-gauge in this appreciation of the value of higher temperatures than boiling water for complete sterilising. When a milkman of Gournay asked Appert for the means to prevent milk from souring, the reply was a method very similar to what is now called "pasteurising". Pasteur, of course, added a correct scientific interpretation to the process, but let him speak himself to the earlier idea as used for wine: "When I published the first results of my experiments on the possible conservation of wine by preliminary heating, it was evident that I only made a new application of the method of Appert, but I was absolutely ignorant that Appert had devised this same application a long time before me. It is, however, this expert manufacturer who, the first, has clearly indicated the possibility of conserving wine through application of heat."

Though Appert may be regarded as the first to have hinted at the idea of vitamins in making it his goal to preserve foods "with all their natural qualities", no mention is ever made of this, nor of his being the first to prepare tabloid foods from meats and vegetables. That seems to have been Appert's destiny: to have been acknowledged in his time by prizes awarded, as well as silver and gold medals, yet to have become almost forgotten in more modern days. He remained a modest man despite his success, working in his factory up to the time of his death and never setting up imposing laboratories or special workshops. When someone told him that a similar book to his and inspired by his had been written, he replied unperturbed: "Now the housekeepers will have two to depend on instead of one." He came at one time to London to demonstrate his processes, but he received no orders, despite the fact that his book on the conserving art went into further editions in 1811, 1813, 1831 (this latter revised and augmented by Appert himself at the age of 81), 1842 (by members of his family), 1857 and 1858. As a result of his vital work progress in preserving became an acceleration, particularly in America with the universal use of cans for every kind of food. Gail Borden introduced sweetened condensed milk; Chicago canned corn and everything from a pig except its squeal; two Englishmen went to Boston and introduced the canning of quince, cranberries and other fruits—all rendered possible as the result of modest Monsieur Appert, "who discovered the art of fixing the seasons. With him spring, summer and autumn exist in bottles like delicate plants protected by the gardener under a dome of glass".

# MINISTRY OF FOOD

## LATEST STATUTORY RULES AND ORDERS

**The list given below is the continuation of the list of Orders published in *Food Manufacture*, October 1, page 238.**

| No. | Date. 1941. | PRICE FIXATION ORDERS |
|---|---|---|
| 1128 | July 30. | Amending the Home-Grown Dredge Corn (Control and Maximum Prices) Order, 1940. (1d.) |
| 1129 | ,, 30. | Amending the Barley (Control and Maximum Prices) Order, 1940. (1d.) |
| 1130 | ,, 30. | The Oats (Control and Maximum Prices) Order, 1941. (2d.) |
| 1132 | ,, 30. | The Home-Grown Wheat (Control and Prices) Order, 1941. (3d.) |
| 1143 | ,, 30. | Amending the Canned Meat Products (Control and Maximum Prices) Order, 1941. (1d.) |
| 1145 | Aug. 1. | The Hay (Maximum Prices) (Northern Ireland) Order, 1941. (2d.) |
| 1146 | ,, 1. | The Oats (Control and Maximum Prices) (Northern Ireland) Order, 1941. (2d.) |
| 1147 | ,, 1. | Amending the Hay (Control and Maximum Prices) Order, 1941. (2d.) |
| 1177 | ,, 7. | The Home Grown Plums (Maximum Prices) Order, 1941. (2d.) |
| 1198 | ,, 11. | The Straw (Maximum Prices) (Northern Ireland) Order, 1941. |
| 1205 | ,, 13. | Amending the Meat (Maximum Retail Prices) Order, 1940. |
| 1206 | ,, 13. | Amending the Meat (Maximum Retail Prices) (Northern Ireland) Order, 1940. |
| 1220 | ,, 15. | Amending the Eggs (Control and Prices) (No. 2) Order, 1941. |
| | | COCOA, CHOCOLATE AND SUGAR CONFECTIONERY |
| 1079 | July 24. | Revoking the Drinking Chocolate (Maximum Prices) Order, 1941. (1d.) |
| | | FEEDING STUFFS |
| 1080 | July 24. | Amending the Feeding Stuffs (Maximum Prices) Order, 1940. (1d.) |
| 1082 | ,, 24. | Amending the Feeding Stuffs (Rationing) Order, 1941. (1d.) |
| 1083 | ,, 24. | Directions under the Feeding Stuffs (Rationing) Order, 1941. (1d.) |
| 1084 | ,, 24. | Amending the General Licence and Directions dated May 3, 1941, under the Feeding Stuffs (Rationing) Order, 1941. (1d.) |

| No. | Date. 1941. | FEEDING STUFFS (*continued*) |
|---|---|---|
| 1144 | Aug. 1. | Amending the Directions dated July 24, 1941. under the Feeding Stuffs (Rationing) Order, 1941. (1d.) |
| | | FLOUR CONFECTIONERY |
| 1069 | July 23. | The Flour (Use of Returnable Bags) Order, 1941. (1d.) |
| 1070 | ,, 23. | General Licence under the Flour (Use of Returnable Bags) Order, 1941. (1d.) |
| | | MEAT |
| 1160 | Aug. 6. | Amending the Bacon (Addition of Borax) Order, 1940. (1d.) |
| 1204 | ,, 13. | The Imported Meat (Marking) Order, 1941. |
| | | MILK AND MILK PRODUCTS |
| 1065 | July 23. | Directions under the Condensed Milk (Distribution) Order, 1940. (1d.) |
| 1207 | Aug. 13. | General Licence under the Milk (Retail Delivery) Restriction Order, 1940, as amended. |
| | | VEGETABLES |
| 1060 | July 22. | The Potatoes (1941 Crop) (Control) Order, 1941. (6d.) |
| 1120 | ,, 28. | The Home-Grown Onions (1941 Crop) (Control) Order, 1941. (1d.) |
| | | GENERAL |
| 1107 | July 26. | Amending the Rationing Order, 1939, and the Preserves (Rationing) Order, 1941. (2d.) |
| 1131 | ,, 30. | Directions under the Sale of Food (Public Air Raid Shelters) Order, 1940. (1d.) |
| 1168 | Aug. 6. | Directions under the Sale of Food (Public Air Shelters) Order, 1940. (1d.) |
| 1184 | ,, 9. | Directions under the Sale of Food (Public Air Raid Shelters) Order, 1940. (1d.) |
| 1222 | ,, 15. | Directions under the Sale of Food (Public Air Raid Shelters) Order, 1940. |

# A NEW QUICK FREEZING SYSTEM*

LUIS H. BARTLETT AND H. E. BROWN

FREEZING foodstuffs by direct contact with a chilled heat transfer fluid has several outstanding advantages over other methods. Some of the most important advantages are :

(1) High rate of heat transfer.

(*a*) Perfect contact between the chilled medium and the foodstuff is assured, thus permitting heat transfer coefficients which are impossible to secure by radiation or by direct contact between irregular shaped objects and a refrigerated surface.

(*b*) Heat is absorbed directly from each piece of food and transfer does not depend upon conduction between contiguous pieces.

(2) Small temperature differentials.

(*a*) Because of the high values of the heat transfer coefficient, it is possible to effect the desired freezing rate without using large temperature differentials.

(*b*) The food is not subjected, externally, to temperatures which are much lower than subsequent storage temperatures.

(*c*) The ability to use small differentials is reflected by savings in the cost of the refrigerating units, which is a very definite economic advantage.

(3) Character of the product.

(*a*) It is widely acknowledged that high freezing rates secure better preservation of the food than low rates.

(*b*) Each piece of frozen product is coated with a film of heat transfer medium which serves as a protective envelope.

(*c*) The finished product is not a solid block of aggregate, but each piece is a separate unit when removed from contact with the heat transfer medium. This allows it to be packed in containers of any desired shape or size.

## The Fluid Immersion Process

The fluid immersion process has not been without certain disadvantages. Some of the factors which have adversely affected its rapid adoption are :

(1) Excessive energy dissipation to the heat transfer medium.

The coefficient of heat transfer, between a surface and a liquid flowing past it, is a function of fluid velocity. High freezing rates imply high fluid velocities, but the power required for viscous circulation is proportional to the square of the velocity. This energy is dissipated as heat in the circulating medium and imposes a non-productive load upon the refrigerating machinery. When liquids of low viscosity, such as salt brines, are used this energy loss is of small magnitude.

Sugar solutions exhibit very much greater viscosity, and, if high velocities are to be maintained, the energy dissipated may become a very appreciable proportion of the total refrigeration load. Excessive viscosities are attained by syrups which have been used for long periods and have accumulated mucilaginous substances extracted from the food. After extended use, such media acquire the characteristics of dilute jelly or jam. Such a fluid or semi-fluid is difficult to circulate at high velocity over a series of heat exchange surfaces. Removal of the dissolved mucilaginous matter is possible, but it is not accomplished by any process short of the complex technique of the sugar refiner and is not feasible for the commercial food freezer.

(2) Incomplete freezing of some foods.

This statement may be somewhat misleading since most foodstuffs are completely frozen only at very low temperatures. Since commercial frozen storage temperatures are of the order of 0° F. it is assumed that foods chilled to this point are completely frozen.

## Chilling Foods by Salt Brines

Little or no difficulty is encountered in chilling foods to 0° F. by means of salt brines. For fruit freezing, the principal direct contact media are sugar solutions, as almost all other liquids have serious disadvantages. It is desirable to chill fruit to 0° F., but in order to accomplish this commercially, it is necessary to maintain the heat transfer medium at a lower temperature.

Unfortunately, syrups which are liquid below 0° F. are very viscous, even without the aggravating effect caused by dissolved mucilaginous matter. A solution containing 62·5 per cent. of invert sugar exhibits viscosities of 1450 and 1650 centipoises, respectively, at 0° and −2° F. No particularly serious difficulty is presented by the problem of circulating this liquid, but only small temperature differences between the refrigerating surfaces and the medium are possible, since its freezing point is −4° F. It is possible to formulate syrups which freeze at still lower temperatures. One solution containing 65·5 per cent. of sugars has a freezing point of −11° F. and viscosities of 3,500 and 4,100 centipoises, respectively at 0° and −2° F., while a 69 per cent. solution of the same sugars freezes at −18° F. and exhibits a viscosity of 12,000 centipoises at 0° F. More concentrated solutions can no longer be described as syrups, " taffy " is a more apt term. A liquid of even 4,000 centipoises viscosity is entirely unsuitable for use as a pump circulated heat transfer medium.

## Overcoming High Viscosities

In order to avoid the difficulties of operation occasioned by these high viscosities, more dilute syrups and higher operating temperatures have been employed. The product is discharged at temperatures above 0° F. and freezing is completed in the sharp freezer or in the storage room. One well-known system employs 50 per cent. invert sugar syrup and 14° F. minimum operating temperature.[1] Another process utilises sugar solutions at 3° to 5° F.[2]

(3) Changes in the heat transfer medium.

(*a*) Dilution of the most frequently used heat transfer media —aqueous solutions of salts or sugar—by juices or wash water adhering to the food is difficult to prevent. Such dilution raises the freezing point of the medium and finally renders the process inoperative through the deposition of an insulating blanket of ice upon the refrigerating surfaces.[6] When salt solutions become too dilute, a portion may be discarded and the remainder strengthened by adding dry salt. Sugars are too high in price to permit the desired concentration of syrup to be maintained by such expedients and some method of water removal is necessary.

(*b*) After a period of use, fluid heat transfer media become contaminated with fragments of food which have been broken off during some step of the process. These cause difficulty by decreasing the fluidity of the medium and by collecting upon the blanketing the refrigerating surfaces. Such fragments may be removed by screens as long as they are frozen. When they thaw or become syrup-logged a soft sticky mass is produced which completely clogs a screen or any filter medium. The solution of this problem is removal before the particles can thaw or become syrup logged.

## The New Process

The University of Texas Polyphase Quick Freezing System retains all the advantages just enumerated and overcomes some of the handicaps discussed. In fact, some of the problems considered as serious disadvantages have been converted into assets.

The heat transfer medium employed is a chilled solution of a freezing point depressing solute, through which is dispersed the solid phase of the solute in finely subdivided form. One example of this type of medium is an invert sugar solution which has been agitated and simultaneously chilled until a disperse solid phase of very small ice crystals has been formed. Heat transfer from foodstuffs to this medium is very fast and is nearly independent of fluid velocity. Apparently the mechanism is not forced convection but is largely conduction.

Decrease in the fluid film resistance of a polyphase medium is probably due to the fact that the thermal conductivity of ice is very much greater than that of the liquid phase. For instance, the conductivity of ice at 0° F. is 1·3 B.T.U./ft. hr.° F., while that of a 63 per cent. syrup is only 0·10 B.T.U./ft. hr.° F. at the same temperature.[4] The weighted mean conductivity of a polyphase medium containing 5 per cent. by weight of ice suspended in 63 per cent. syrup is 0·27 B.T.U./ft. hr.° F., which is 1·38 times the conductivity of the liquid phase. Lees[5] states that the thermal conductivity of two component heterogeneous mixtures is slightly less than the weighted mean of the conductivity of the

individual components. However, the conductivity of a polyphase medium is greater than that of the liquid phase, and this value increases as the percentage of solid phase increases.

Another factor which may explain the increased heat transfer rate is the great thermal capacity of the polyphase medium in comparison to the liquid phase medium. The ratio may be mathematically derived in the following manner. Assume a polyphase medium having a composition of $c$ pounds of solute per pound of solvent. The fraction $x$ of the medium is solvent in the solid phase in a finely dispersed form. The composition of the liquid phase, in pounds of solute per pound of solvent is

$$\frac{c_o}{1-x(1+c)} \quad \ldots\ldots\ldots\ldots \text{Eq. 1}$$

Now the freezing point depression produced by the dissolved solute is

$$t=\Delta T_f \frac{1000c}{M} \quad \ldots\ldots\ldots\ldots \text{Eq. 2}$$

in which $\Delta T_f$ is the molal freezing point depression and M is the molecular weight of the solute. Eliminate $c$ by combining eqs. 1 and 2.

$$t=\frac{1000c\,\Delta T_f}{M(1-x_L(1+c_o))} \quad \ldots\ldots\ldots\ldots \text{Eq. 3}$$

Differentiate eq. 3 with respect to $t$ and $x$,

$$dx=\frac{M(1-x_L(1+c_o))^2}{1000c(1+c_o)\Delta T_f}dt \quad \ldots\ldots\ldots \text{Eq. 4}$$

The heat absorbed by the medium when its temperature is raised by the differential amount $dt$, is

$$dQ=L_f dx+(xC_s+[1-x]C_1)dt \quad \ldots\ldots \text{Eq. 5}$$

in which $L_f$ is the latent heat of fusion of the solvent, $C_s$ is the thermal capacity of the solid solute, and $C_1$ is the thermal capacity of the liquid phase. By combining eqs. 4 and 5, the expression

$$\frac{dQ}{dt}=\frac{L_f M(1-x[1+c_o])^2}{1000c_o(1+c_o)\Delta T_f}+xC_s+(1-x)C_1 \quad \ldots \text{Eq. 6}$$

is derived, which is the thermal capacity of the polyphase medium. The ratio of the thermal capacities of the polyphase and the liquid phase media is derived by dividing eq. 6 by $C_1$.

$$\frac{dQ/dt}{C_1}=\frac{L_f M(1-x[1+c_o])^2}{1000c_o(1+c_o)\Delta T_f C_1}+\frac{xC_s}{C_1}+1-x \quad \ldots \text{Eq. 7}$$

The following table of values applies to a polyphase medium composed of 60 parts of invert sugar and 40 parts of water, of which 5 parts are in the form of dispersed ice.

$c_o=$ 1·5
$M=$ 180·0
$\Delta T_f=$ 3·9° F.
$x=$ 0·05
$C_1=$ 0·70 B.T.U./lb. °F. ..... 8
$C_s=$ 0·48 B.T.U./lb. °F. ..... 9
$L_f=$ 143·0 B.T.U./lb. ..... 10

## TABLE I.

COMPARISON OF THE HEAT REMOVED FROM CUBES OF RAW CARROT AT AN INITIAL TEMPERATURE OF 77° F., BY CONTACT WITH POLYPHASE AND WITH LIQUID PHASE WATER-INVERT SUGAR MEDIA AT 1·5° ± 0·5° F.

| *Polyphase Medium.* | | | | *Liquid Phase Medium.* | | | |
|---|---|---|---|---|---|---|---|
| *Run Number.* | *Contact Time, Minutes.* | *Heat Removed B.T.U/lb.* | *Temperature of Medium Degrees F.* | *Run Number.* | *Contact Time, Minutes.* | *Heat Removed B.T.U/lb.* | *Temperature of Medium Degrees F.* |
| | | | *Data for 0·8 in. Cubes.* | | | | |
| 1 | 6·4 | 156 | 1·1 | 28 | 6·4 | 128 | 1·4 |
| 2 | 6·4 | 147 | 1·7 | 29 | 6·4 | 131 | 1·7 |
| 3 | 6·4 | 150 | 1·6 | 30 | 6·4 | 139 | 1·5 |
| 4 | 6·4 | 154 | 1·3 | 31 | 6·4 | 134 | 2·0 |
| | | | | 32 | 6·4 | 135 | 1·8 |
| mean | 6·4 | 152 | 1·4 | mean | 6·4 | 133 | 1·7 |
| 5 | 8·0 | 160 | 1·0 | 33 | 8·0 | 143 | 1·4 |
| 6 | 8·0 | 156 | 1·6 | 34 | 8·0 | 134 | 1·7 |
| 7 | 8·0 | 163 | 1·2 | 35 | 8·0 | 144 | 2·0 |
| | | | | 36 | 8·0 | 146 | 1·7 |
| | | | | 37 | 8·0 | 142 | 2·0 |
| mean | 8·0 | 160 | 1·3 | mean | 8·0 | 142 | 1·8 |
| 8 | 9·5 | 167 | 1·0 | | | | |
| 9 | 13·5 | 166 | 1·7 | 38 | 13·5 | 147 | 1·4 |
| 10 | 13·5 | 172 | 1·2 | 39 | 13·5 | 161 | 1·4 |
| 11 | 13·5 | 172 | 1·2 | 40 | 13·5 | 154 | 1·6 |
| mean | 13·5 | 170 | 1·4 | mean | 13·5 | 154 | 1·5 |
| 12 | 18·5 | 177 | 0·5 | | | | |
| | | | *Data for 1·0 in. Cubes.* | | | | |
| 13 | 6·4 | 137 | 1·1 | 41 | 6·4 | 119 | 1·3 |
| 14 | 6·4 | 123 | 1·7 | 42 | 6·4 | 112 | 1·4 |
| 15 | 6·4 | 128 | 1·1 | 43 | 6·4 | 117 | 0·8 |
| 16 | 6·4 | 129 | 1·7 | | | | |
| mean | 6·4 | 129 | 1·4 | mean | 6·4 | 116 | 1·2 |
| 17 | 8·0 | 141 | 1·8 | 44 | 8·0 | 122 | 1·5 |
| 18 | 8·0 | 142 | 1·0 | 45 | 8·0 | 124 | 1·7 |
| 19 | 8·0 | 142 | 1·2 | 46 | 8·0 | 119 | 2·0 |
| 20 | 8·0 | 134 | 1·0 | | | | |
| 21 | 8·0 | 137 | 1·6 | | | | |
| mean | 8·0 | 139 | 1·3 | mean | 8·0 | 122 | 1·7 |
| 22 | 9·5 | 151 | 1·4 | | | | |
| 23 | 11·5 | 166 | −1·5 | | | | |
| 24 | 13·5 | 164 | 1·0 | 47 | 13·5 | 131 | 1·7 |
| 25 | 13·5 | 161 | 1·2 | 48 | 13·5 | 140 | 1·0 |
| 26 | 13·5 | 170 | 1·5 | 49 | 13·5 | 143 | 1·0 |
| 27 | 13·5 | 165 | 1·2 | 50 | 13·5 | 136 | 1·4 |
| mean | 13·5 | 165 | 1·2 | mean | 13·5 | 137 | 1·3 |

Substituting these values in eq. 7.

$$\frac{dQ/dt}{C_1} = 2{\cdot}04$$

## Experimental Technique

Whatever the exact mechanism of heat transfer may be, it has been shown experimentally that the polyphase medium removes a given quantity of heat from foods in about 60 per cent. of the time required by a liquid medium of similar composition and at the same temperature. The experimental technique was as follows:

Cubes of fresh carrot were cut accurately to sizes of 0·8 in. and 1·0 in., portions of approximately 200 grams were weighed out, placed in a thermostat and brought to 77° F.

The weighed portion was fed into one flight of the rotating helicoid of the freezing mechane, in which the medium was held at 1·5° ± 0·5° F. The polyphase medium was 56 per cent. invert sugar and its freezing point was 4° F.; at the operating temperature approximately 5 per cent. of ice was present. The liquid medium was 59 per cent. invert sugar and its freezing point was 0° F. After passage of the cubes through the freezer, they were removed from the medium, quickly wiped with a dry cloth and transferred to a tared calorimeter, which was weighed to determine the quantity of medium adhering to the cubes. The amount of heat required to thaw and raise the temperature to 77° was determined and corrected for the amount of medium adhering to the cubes.

One cube from each run was split, in order to observe the depth of freezing. It is interesting to note that freezing has progressed to the centre when approximately 155 B.T.U./lb. has been removed from carrots. No attempt to determine the interior temperature of the cubes was made, since such measurements upon small objects are subject to serious error. The only truly scientific basis for the comparison of processes whose primary function is the removal of heat, is to measure the quantities of heat transferred under controlled conditions. The results of these experiments are listed in Table I.

## Heat Loss

It may be demonstrated mathematically that the quantity of heat lost by a body in contact with a cold fluid is expressed by the logarithmic decay law—

$$Q = Q_\infty (1 - e^{-k\theta})$$

in which $Q$ is the heat lost in $Q$-time, $Q_\infty$ is the maximum heat transferred in infinite time, $e$ is the Napierian logarithm base, and $k$ is a constant depending upon the dimensions of the body and upon the thermal conductivities of the body and of the fluid.

The fact that heat transfer rates are nearly independent of fluid velocities enables very low circulation rates to be used and correspondingly reduces energy losses to the medium. It also permits the successful employment of very viscous media. Intrinsically, high viscosity is no advantage, but since sugar solutions at low temperatures are very viscous, the ability to handle such media is a great advantage. Not only is the rate of freezing increased by the larger temperature differential, but the medium is maintained at temperatures low enough to chill foods completely to 0° F. or even lower, instead of merely chilling the outside and leaving the interior substantially unfrozen.

It has been noted previously that the product is not frozen into a solid block of aggregate at the time it is removed from contact with the heat transfer medium. However, if it is not reduced to a temperature which closely approaches that of the storage room, the packaged product will freeze solidly together.

The senior author has observed immersion frozen sliced peaches discharged from the freezer at 10° F., packaged in 20-lb. cans, and put in 0° F. storage. After 24 hours the contents of the cans were frozen together almost as solidly as if the conventional sharp freezing process had been employed.

An entirely different effect is obtained by chilling completely to 0° F. before packaging and storing in rooms which are held substantially at this temperature. No freezing together occurs, and the product may be transferred from one container to another almost as readily as an equivalent quantity of crushed rock.

## Advantages of Chilling before Packaging

The advantages of this characteristic are clearly evident. It is possible to freeze foods, store in large containers or even in bulk, and pack later in such containers as the customer may specify. The final consumer is enabled to purchase large packages and remove the quantity desired for immediate needs, without resorting to the use of an axe or crowbar or to the doubtful expedient of allowing the entire mass to thaw and refreezing the unused portion. The loose pack is also desirable from the viewpoint of the retail distributor. Displays of the individually frozen foods are more colourful and have a much greater sales appeal than any display of packages or of the food frozen into a solid block.

## Dilution of Heat Transfer Liquid

One bugaboo of the immersion freezing process—namely, dilution of the heat transfer fluid—is neatly hurdled by the polyphase medium. The composition of the liquid portion of a system containing the solid phases of its components is a function only of temperature. If water is added to an invert sugar polyphase medium held at constant temperature, nothing occurs except an increase in the amount of the ice phase. Foods frozen in this medium carry quantities of it upon their surfaces to the drainer. In the draining period the bulk of the suspended ice crystals adheres to the frozen product, while the liquid portion flows off and is returned to the main body of medium. This action establishes a self-regulating concentrating mechanism. If large quantities of wash water or juices are brought into the polyphase medium by the unfrozen feed, and frozen product carries it out in the form of adhering ice crystals, it is necessary only to add periodically concentrated syrup to compensate for that which is removed upon the finished article. It is not intended to imply that this mechanism will take care of any amount of wash water adhering to the unfrozen material, but it will maintain a constant composition of the medium when operating upon normally drained washed fruit.

A similar action occurs with fragments of food which may be broken off in the preparing process and introduced into the polyphase medium. After a certain period of operation, equilibrium is established and these fragments are removed at the same rate at which they enter.

## Description of Machine

The mechanical element of the system comprises a refrigerated surface in contact with the medium, an agitator which operates close to this surface, and suitable means to secure contact between the chilled medium and the foodstuff and also to effect separation when freezing has been accomplished. Probably the simplest form of equipment is a refrigerant jacketed horizontal tube, which is partly filled with medium and inside which a screw conveyor operates. This tube is also equipped with hoppers at each end, a return tube to permit continuous circulation of the medium, and a screen or grid to effect separation of the frozen food from the stream of medium.

In operation, food is dropped upon the surface of the polyphase medium in the feed hopper, where it floats partially submerged. From there it is carried into the screw conveyor by the motion of the stream of medium. This stream serves as a perfectly elastic conveyor which cannot deform or crush the most delicate portions of food. The speed of the conveyor may be regulated to allow complete freezing of various sized articles during their travel through the tube. An unusual drive gear, which rotates the screw about one-fifth turn forward and then about one-sixth turn backward, is employed. This motion applies the required agitation to the medium and still secures the effective forward motion to permit complete freezing. Speed may be varied to secure contact time ranging from 5 to 17 minutes. After essentially complete freezing has occurred and the individual pieces have acquired considerable mechanical strength, the stream of medium flows through the screen and returns to the feed hopper. This screen is raked periodically to remove the frozen product, which is then drained and packaged.

The machine embodies a number of very desirable features:

(1) Extreme simplicity.

(*a*) Small units have only one moving part in contact with the heat transfer medium while the largest machines have four.

(*b*) The moving parts, helicoid conveyors, are simple and sturdy. They perform the double function of agitators and conveyors.

(*c*) The refrigerated surface is a single cylinder, without seams or joints which might leak refrigerant into the medium. It is cooled by direct expansion, using the flooded system. Cleaning is simply and easily performed.

TABLE II.

CONTACT TIME REQUIRED BY THE UNIVERSITY OF TEXAS POLYPHASE QUICK FREEZING SYSTEM TO FREEZE VARIOUS FOODS TO THE CENTRE, USING WATER-INVERT SUGAR MEDIUM AT −2° F.

| *Food.* | *Variety.* | *Size.* | *Portions.* | *Contact Time, Minutes.* |
|---|---|---|---|---|
| Apple | Jonathan | 2–2½ ins. | eighths (*a*) | 5– 7 |
| Apple | King David | 2½ ins. | eighths (*a*) | 7– 9 |
| Apple | Stark | 2½–3 ins. | eighths | 8–10 |
| Banana | | 1 in. | whole | 10–12 |
| Fig | Ramsay seedling (*b*) | 1½–1¾ ins. | whole (*c*) | 13–17 |
| Grapefruit | Marsh seedless pink | 64 | segments (*d*) | 5– 8 |
| Grapefruit | Marsh seedless white | 64 | segments | 5– 8 |
| Jujube | Lang | 1 in. | whole | 6– 8 |
| Peach | Augbert | 2 ins. | eighths (*c*) | 5– 7 |
| Peach | Elberta | 2½ ins. | eighths (*c*) | 7– 9 |
| Peach | Montopolis | 2 ins. | eighths (*c*) | 5– 7 |
| Pear | Bartlett | 2 ins. | quarters (*a*) | 5– 7 |
| Pear | Kieffer | 2½ ins. | quarters (*a*) | 7– 9 |
| Prune | Italian | 1¼ ins. | halves | less than 5 (*g*) |
| Strawberry | Unknown | ⅞ in. | whole | 6– 8 |
| Snap bean | Kentucky wonder | | whole | less than 5 (*g*) |
| Carrot | Unknown | See Table I. | | |
| Green pea | Telephone | ⅜ in. | shelled | less than 5 (*g*) |
| Chicken | Fryer | 1½ lb. | disjointed | 5–11 |
| Chicken | Fryer | 1½ lb. | whole | 8 (*e*) |
| Pork shoulder | | ¾ in. slice | | 6 |
| Shrimp | | 29 count | tail | less than 5 (*e*, *f*, *g*) |
| Shrimp | | 54 count | tail | less than 5 (*e*, *f*, *g*) |

(*a*) Fruit was peeled and cored by machine.
(*b*) See reference 5 in bibliography.
(*c*) Fruit was lye peeled.
(*d*) Fruit was steam-peeled, rag peel removed by lye, and segmented by hand.
(*e*) These items were frozen in polyphase water-salt medium at −2° F.
(*f*) Unfrozen shrimp was iced.
(*g*) Contact time less than 5 minutes was impossible to secure with the experimental apparatus. It is estimated that the prunes required 4 minutes, the snap beans 4 minutes, green peas 3 minutes, 29 count shrimp 4½ minutes, 54 count shrimp 3 minutes.

(2) Light and compact. A unit to freeze 50 lbs. of product per hour weighs 700 lbs. and requires a floor area 8 ft. by 16 ins.

(3) Low power required, less than ¼ h.p. for the 50 lbs. capacity unit, excluding the power required for refrigeration.

(4) High coefficient of heat transfer to the refrigerant from the polyphase medium. This is due to the action of the rotating helicoid which sweeps away the fluid film at each revolution. It is estimated that coefficients as high as 200 B.T.U./hr. sq. ft.° F. may be secured.

(5) The freezing process is continuous.

(6) Very viscous heat transfer media are handled successfully.

(7) Small quantities of media are required to charge the machine. Only 18 gallons are necessary for the 50-lb. capacity unit.

(8) The unit may be brought quickly to operating temperature after a shutdown period.

(9) Only very small area to be insulated.

(10) Low first cost and maintenance charges.

(11) Units of any capacity may be constructed and operated economically. This feature makes the system available to the locker plant. Previous fluid contact freezing systems have been so cumbersome and expensive that the locker plant operator was unable to employ them.

(12) Since the machine is light and compact, it may be readily transported. The 50-lb. capacity unit may be moved by a half-ton pickup truck, and thus permit the freezer to follow the harvest from field to field or from orchard to orchard. It also may be installed on a fishing boat and freeze sea foods literally " while they are still kicking ".

## Applications of the System

Any food which does not have a high ratio of external surface to mass or which permits free drainage of adhering fluid may be advantageously frozen by this system. Leaf vegetables are excluded, but nearly any other foodstuff may be successfully processed.

A wide variety of products has been frozen with successful results in every case. Some of these are listed in Table II. Perhaps the idea of frozen vegetables and meat coated with invert sugar may be somewhat startling. It is probable that some tastes will summarily reject the innovation. However, many excellent cooks add sugar to foods which are ordinarily not considered sweet. Peas, corn, tomatoes, carrots, and squash are among these. Snap beans are improved in flavour by the coating of sugar, although insufficient amounts adhere to impart a sweet taste to the cooked vegetable. The syrup adhering to chicken and pork produces a very attractive brown surface when fried or broiled, but again no sweet taste is present.

It is certain that a syrup film offers considerable protection against oxidation and dehydration, and for this reason it seems desirable to quick freeze suitable vegetables and flesh foods by contact with the sugar-water polyphase medium. This problem is now under investigation by the Department of Home Economics of the University of Texas.

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• Presented at the Food Preservation Conference, the University of Texas, March 13-14, 1941.

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LETTER TO THE EDITOR

## MESSAGE FROM NEW ZEALAND

TO THE EDITOR OF FOOD MANUFACTURE

DEAR SIR,—We take this opportunity of congratulating you on the regular arrival each month of FOOD MANUFACTURE, from which we have at times obtained quite valuable information applicable to our business.

Lines manufactured are brewers' caramel, drained cherries, preserved ginger, cordials and summer drinks, coffee essence, curry powder, calf food, besides the grinding of spices and the roasting and grinding of coffee.

Yours faithfully,
N.Z. COFFEE AND SPICE CO., LTD.

# MINISTRY OF FOOD ITEMS

## THE LARD (LICENSING) ORDER, 1941

1. In this Order: "Lard" means animal lard, including hog grease. "Sale by wholesale" means any sale other than a sale by retail. "The Minister" means the Minister of Food.

2. No person shall on and after the 22nd day of September, 1941—(i) produce, manufacture, or refine, or engage in the production, manufacture, or refining of lard; or (ii) sell lard by wholesale, except under and in accordance with the terms and conditions of a licence granted by or on behalf of the Minister.

3. Every person licensed under the provisions of this Order shall—(i) comply with any directions or instructions given by or on behalf of the Minister relating to the packing, marking, or labelling of lard produced, manufactured, refined, or sold or offered for sale by that person; and (ii) make such returns and furnish such particulars relating to lard produced, manufactured, refined, or sold by him as the Minister may from time to time require.

4. The provisions of this Order are subject to any authorisations or licences granted by or on behalf of the Minister.

5. Infringements of this Order are offences against the Defence (General) Regulations, 1939.

6. This Order may be cited as the Lard (Licensing) Order, 1941.

## PRESERVED VEGETABLES

The Preservation of Vegetables and Vegetable Products (Licensing and Control) Order, 1941, dated August 27, 1941, states:

1. In this Order: "The Minister" means the Minister of Food. "Preservation" means the preservation of vegetables—(*a*) by packing the same in a can, bottle, or air-tight container; or (*b*) by freezing. "Specified vegetable product" means any product mentioned in the Schedule to this Order. "Vegetable" means any vegetable (including tomatoes and edible fungi)—(i) whether or not mixed with any other article; and (ii) whether fresh or dried, cooked, or otherwise processed or prepared, and includes vegetable juices or purées and vegetables contained in vegetable rolls and similar products, but does not include soups or pickled vegetables or save as hereinbefore provided any manufactured product produced from vegetables.

2. Except under and in accordance with the terms of a licence granted by or on behalf of the Minister, no person shall preserve any vegetable or any specified vegetable product. Provided that nothing in this Article shall prohibit—(*a*) the preservation by packing in a can, bottle, or other air-tight container of any vegetable contained in a specified meat product conforming to the provisions of the Canned Meat Products (Control and Maximum Prices) Order, 1941, as amended; (*b*) the preservation by any person during the period of twelve months commencing on the first day of September, 1941, or any successive period of twelve months thereafter of a quantity of vegetables not exceeding in any such period 20 cwts.; (*c*) the preservation of vegetables or vegetable products otherwise than for the purposes of sale (including sale after processing or manufacture).

3. Every person licensed under Article 2 of this Order shall keep or cause to be kept an accurate record of all agreements made by him for the purchase of vegetables (including any such agreements entered into before the date of the coming into force of this Order where any of the vegetables thereby agreed to be purchased have not been delivered at that date), such record to show the name and address of the seller, the description and quantities (or estimated quantities) of the vegetables purchased, and the dates of delivery and prices fixed by such agreements.

4. The provisions of this Order are subject to any authorisations or directions which may at any time be given or granted by or on behalf of the Minister.

5. Infringements of this Order are offences against the Defence (General) Regulations, 1939.

6. This Order shall come into force on the first day of September, 1941, and may be cited as the Preservation of Vegetables and Vegetable Products (Licensing and Control) Order, 1941.

### THE SCHEDULE

SPECIFIED VEGETABLE PRODUCTS

Cooked macaroni with or without sauce. Cooked spaghetti with or without sauce.

[E]

## LARD AND HOG GREASE

The Minister of Food has made an Order prohibiting, except under licence, the production, refining, or selling by wholesale of lard and hog grease. The Order comes into force on September 22, 1941, but bacon curers and butchers will be permitted, under general licence to be issued shortly, to produce lard without the necessity for holding individual lard producers' licences.

Applications for licences to produce or refine lard or hog grease, or to sell hog grease by wholesale, should be made to the Ministry of Food (Oils and Fats Division), Colwyn Bay, Denbighshire. Wholesalers of lard who hold licences to sell cooking fat by wholesale will shortly be issued with new licences to include lard. Other wholesalers of lard should apply for a licence to the Oils and Fats Distribution officers in the Divisional Food Areas in which they are trading. The addresses of these officers can be obtained from any local Food Office.

## THE FOOD (RESTRICTION ON DEALINGS) ORDER, 1941

It was recently announced by the Ministry of Food that certain classes of manufacturers would be exempt from the necessity to obtain individual licences, under the Food (Restriction on Dealings) Order, 1941, to trade otherwise than by retail in the specified foodstuffs.

The Minister of Food has now made a General Licence which gives the following exemptions:

1. Manufacturers licensed under any of the Orders listed below who engage in the manufacture, canning or bottling of any given food may sell any such food manufactured by them in accordance with their licence to any person:

The Biscuits (Licensing and Control) Order, 1941.—Biscuits, rusks and crispbreads.

The Butter (Licensing and Control) Order, 1941.—National Butter.

The Cereal Breakfast Foods (Control and Provisional Prices) Order, 1940.—Cereal Breakfast Foods.

The Cheese (Licensing and Control) Order, 1940.—Cheese.

The Condensed Milk (Licensing and Control) Order, 1940.—Condensed Milk.

The Jam, Marmalade and Preserved Fruit (Licensing and Control) Order, 1941.—Jam, Marmalade, Canned Fruit.

The Milk Powder (Licensing and Control) Order, 1940.—Milk Powder.

The Pickles and Sauces (Control and Maximum Prices) Order, 1941.—Pickles and Sauces.

The Preservation of Vegetables and Vegetable Products (Licensing and Control) Order, 1941.—Canned Vegetables (including cooked macaroni and spaghetti).

The Processed Cheese (Control and Maximum Prices) Order, 1941.—Processed Cheese.

2. Manufacturers of jam, marmalade or canned fruit, and canners and bottlers of vegetables, who are not required to be licensed either under the Jam, Marmalade and Preserved Fruit (Licensing and Control) Order, 1941, or under the Preservation of Vegetables and Vegetable Products (Licensing and Control) Order, 1941, may also sell otherwise than by retail such products manufactured by them to any person.

3. Millers licensed under the Oat Products (Control and Maximum Prices) Order, 1940, may sell oatmeal or oat flakes produced by them to any person.

4. A flour miller, as defined in the Flour (Control and Prices) Order, 1941, may sell otherwise than by retail to any person semolina produced by him and any flour other than semolina, whether it is produced by him or not.

5. Distributing dealers or wholesale dealers, licensed under the Feeding Stuffs (Licensing and Control) Order, 1941, to sell dried milk and dried milk products as feeding stuffs, may sell otherwise than by retail to any person milk powder for use as a feeding stuff.

The General Licence also authorises purchases from manufacturers to whom the above exemptions apply.

The General Licence only authorises flour millers to sell flour not manufactured by them. Any other firms who wish to sell otherwise than by retail products not manufactured by them, even if they hold licences to manufacture the same products, must obtain individual licences under the Food (Restriction on Dealings) Order.

# CALIFORNIAN DRIED FRUITS

DR. W. V. CRUESS

DURING the present emergency with transatlantic cargo space at a premium and with fresh fruits for jam and marmalade costly and scarce, much interest has developed in the possible use of dried fruits for jam-making. Dried apricots weigh only one-sixth as much as an equivalent amount of canned, syrupless solid-pack apricot jam or "pie" fruit. The ratio is even more favourable to the dried when compared with the barrelled fresh fruit for jam purposes. And, naturally, much less cargo space is required for dried fruit than for the corresponding amount of jam.

At the request of the Surplus Commodities Corporation of the United States Department of Agriculture, the writer made a number of experimental lots of jam from dried apricots and dried prunes. To the dried apricots was added approximately four parts of water by weight; to 50 lb. of fruit, 200 lb., or 25 U.S. gallons of water. The mixture was heated to boiling and set aside overnight. It was then boiled until soft; pulped or ground and about 1 lb. of sugar added to each lb. of pulp. It was cooked to desirable consistency—namely, 218° to 220° F.; or to about 66 to 68 per cent. solids.

Since the dried fruit contains $SO_2$, the jam must be packed in glass, not in tin. We found it very good in flavour, colour, texture and appearance. Dried peaches were made into jam in similar manner.

Dried prunes were brought to a boil in three parts of water to one of prunes; allowed to stand overnight; boiled a short time; pulped to remove seeds; and cooked to jam consistency with one of sugar to one of pulp. The jam, however, was much more pleasing if to the pulp was added 0·5 per cent. of citric acid, as prunes are low in acidity. Addition of 10 per cent. of cooked, chopped orange peel, or a small amount of orange oil improved the flavour for some persons. A blend of 50 parts apricot to 50 of prune was satisfactory also.

We have had fair success in slicing citrus fruits thin; steaming on screen trays 10 to 12 minutes; dehydrating; soaking in water; cooking until tender; adding sugar and cooking to a marmalade. About three-quarters of the fruit was used for juice and one-quarter for peel to give marmalade consistency. If one wished to be "Scotch", he could use all of the peel and pulp and make a thick jam-like marmalade.

The citrus fruits (oranges, lemons, grapefruit) could be dehydrated and shipped to Britain, where it could be made into marmalade.

A mixture of 3 parts orange, 1 of lemon and 1 of grapefruit gives a marmalade with a slightly bitter taste and of good general quality.

# THE TRAINING OF A CHEMIST

AT a meeting of the British Association of Chemists on September 13 Mr. Thomas McLachlan read a paper on "The Training of a Chemist", which opened a lively discussion.

The lecturer briefly described his chemical education at Finsbury Technical College and considered that, although the Finsbury training had severe limitations, it had something that the universities lacked. Speaking of the chemical profession as a whole, Mr. McLachlan said its members lacked the *savoir faire* of the lawyer, physician and engineer. Of the university graduate, his experience was that he entered the laboratory with a knowledge of theory; he knew his way about the literature; he knew how to manipulate formulæ of alkaloids and dyestuffs, but not test tubes; and he thought it *infra dig.* to wash up his glassware.

Mr. McLachlan thought that students should enter the university at an earlier age, studying a wider range of subjects there and spend some of their vacations in obtaining practical experience of industrial work and a knowledge of their fellow-men. The requirements for the Ph.D. degree should be stiffened.

During the subsequent discussion Professor Donnan disagreed on the point of the age of students. He would have them older, in order that they might have had the opportunity of acquiring a better general education. At present students were insufficiently educated and specialisation occurred too early. He cited Oxford as a "terrible example" of this.

Dr. Dunstan, who followed Professor Donnan, declared himself an advocate for a longer and more complete general school training. Early school training was important and in particular a classical education enabled the student to obtain a background of his own language.

In the branch of industry with which he was connected the tendency has been to recruit men from the Ph.D. class. While he admired those people who worked eight hours a day and then devoted three hours to evening study in order to obtain a degree, he thought it was too hard a task for the ordinary mortal.

Dr. Himus complained that the ordinary chemical student cannot write English. Mr. McLachlan, in his reply, agreed entirely with all those who had supported a wide system of education, but pointed out that where he differed was in the matter of its application. School education was the same for the lawyer, the doctor, the engineer, and the accountant, yet in his view the chemist was more narrow in his outlook than almost any other professional man, and therefore the fault must lie rather in their university training than in their school education. With one speaker, he thought that a teacher was born and not made, but felt that even a born teacher would benefit from a little training in the art of teaching; there was, in fact, a movement on foot among teachers to oblige all those who wish to hold teaching appointments at public schools and the universities to take a course at a training college.

## The Dairying of the Future (*Cont. from page 250*)

In nominating persons for such a Commission it is important that they shall be progressive, impartial and competent in their own fields, and, moreover, with a wide experience of the industry. The ramifications of dairying are such that a brilliant man can easily do foolish things unless he has had considerable first-hand experience of the industry. A judicious blend of older experienced men with progressive, technically-minded younger men is obviously called for. The appointments should be full-time and salaries should be sufficiently high to attract the best men. The members must be able to keep in touch with all developments of the industry by frequent travel at home *and abroad*. The M.I.C. should have executive powers and be responsible only to Parliament—*i.e.*, it should not be possible for reactionary bodies, local authorities or vested interests to stand in the way of improvements that would benefit the country and industry as a whole.

Many bits and pieces exist that could be welded together to form a Commission. It would probably be better, however, to start with a clean slate as far as the central co-ordinating body is concerned. Existing machineries could be used for the control of definite aspects. For example, the Milk Marketing Board, which has handled the purely marketing aspects of the industry in an amazingly efficient way considering the difficulties of the problem, would automatically continue as the marketing division of the M.I.C.

2. *The need for an independent testing and advisory service.*

The maintenance of the quality of any product obviously depends upon constant testing. At present the testing of milk is carried out in a very haphazard way. The particular tests used are not a matter of great importance provided they are properly performed, their limitations appreciated and their interpretation is intelligently carried out. The methods of sampling and holding the sample are, however, of the utmost importance, and standardisation is badly needed in this respect.

One of the difficulties is the fact that milk is usually tested by the buyer but not the producer, so that the latter frequently fears that the results are biased. Many creameries have accepted bad quality milk for fear of offending the farmer, who usually threatens to sell his milk to another concern. Both producer and retailer would be prepared to accept the findings of a competent and disinterested testing organisation.

It may be thought that the present scheme affords an independent testing by public health and other bodies. No greater example of inefficiency and chaos could be given than our present methods, and this is largely due to the fact that the testing and responsibility for control are in the hands of the local authorities. Some are very enthusiastic and efficient. Others have no interest and are grossly inefficient. Thus cases are known where accredited producers may get their licence in winter when conditions are easy and never have their milk tested again. It is no wonder that milk buyers are dissatisfied (a mild term!) with the present condition of things. The fault lies not in the scheme itself but in its administration. Efficiency in the production of any material can only be maintained by constant testing by an impartial and efficient body.

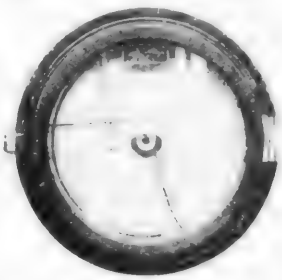
*References will be given in Part II.*

(*To be continued*)

# NEWS FROM THE INDUSTRY

## Temperature Recorder for Pasteurisers

A type of recorder for use on milk pasteurisers is the Drayton Temperature Recorder, which is fitted with a clockwork making one revolution in twelve hours and has a standard chart of 10 inches. The case, which is suitable for wall mounting, is painted in white enamel and fitted with a dust- and damp-proof cover. The thermostatic system is fitted with a stainless steel bulb and acts on the movement through the expansion of a volatile liquid filling. As each instrument is provided with several feet of capillary tubing, it can be installed in a way that best suits the convenience of the operatives on site. Although the Drayton Recorder is a robust and strongly constructed instrument, it possesses an accuracy of ± 2° of the scale range. This high degree of accuracy is due to a directly operated helical wound bourdon movement in which transmission linkage is eliminated in single pen instruments and reduced to the minimum in two pen instruments.

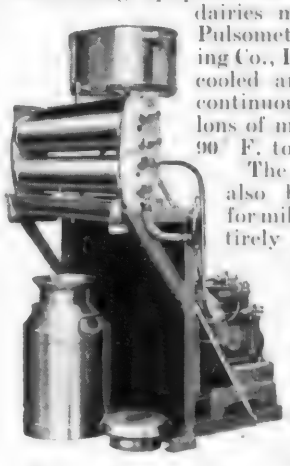


In addition to the Drayton Recorder, three different types of temperature regulators which are used for the automatic control of pasteurisers and other steam-heated dairy equipment are of interest.

* * *

## Milk Cooling Plant

Using methyl chloride ($CH_3Cl$), the milk-cooling equipment for farmers and dairies made by the Pulsometer Engineering Co., Ltd., is water cooled and will cool continuously 45 gallons of milk per hour 90° F. to 40/42° F. The plant can also be arranged for milk cooling entirely without the use of water, its cooling capacity being 40 gallons of milk per hour from 65° F. to 40/42° F.



This cooling plant represents a noteworthy advance in refrigerated dairy equipment and is a development of the ammonia type milk cooler. In place of the hand-controlled ammonia compressor previously used, the electric automatic methyl chloride refrigerator is incorporated.

## Dried Milk

The increasing use of dried milk, either as a principal or subsidiary constituent of a large variety of food products, has led to great developments in its manufacture in this country in recent years. One of the largest producers is Messrs. Dried Milk Products, Ltd., whose factories are to be found in the chief milk areas and which absorb a very large gallonage for conversion into dried milk. Milk is usually dried by evaporation of the water content on twin-roller steam-heated machines, as illustrated, or by spraying into a chamber through which hot air is circulated. Both types of plant are operated by this company. Spray process powder is sold in peace-time under "Golden Bloom" and "Golden Glow" brands principally to the bakery and ice cream trades, but also for a variety of other food purposes. Roller-process powder is generally recognised to be more suitable for certain purposes, including infant feeding.

During war-time the normal sales activities of the dried milk trade are controlled by the Ministry of Food, who allocate the available stocks according to priority needs. This has necessarily involved total prohibition of usage for certain purposes, such as ice cream manufacture. In other directions, such as domestic consumption, comparatively new fields are likely to be opened up. The attention given to dried milk by the Ministry illustrates its value as a highly nutritious, readily stored, and conveniently used part of the national diet.

In addition to manufacturing dried milk, Messrs. Dried Milk Products operated plants for the manufacture of butter, cheese, cream (both fresh and sterilised), evaporated and condensed milk and casein. War conditions have concentrated activity on those products which are regarded as essential in the national interest.

* * *

## Luminescent Materials in Industry

In view of the wide application of luminescent materials in industry, the Ministry of Home Security has issued a Technical Bulletin, C. 17, which gives an analysis of existing materials and a great deal of information concerning their uses and suitability or otherwise for practical purposes.

Copies of the bulletin can be obtained, free on application, from the Ministry of Home Security, Research and Experiments Department, Forest Products Research Laboratory, Princes Risborough, Aylesbury, Bucks.

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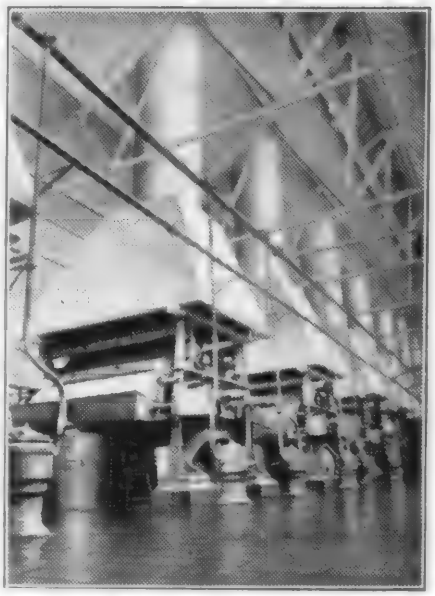
## More Canned Meats

A first distribution of canned meats obtained from the United States under the Lease-Lend Act will be made soon. By this month sufficient stocks should have been built up to enable a wide distribution to be made.



Dried Milk Manufacture

## Raw Materials Conference

At the recent conference held in London delegates representing the British Government, Empire Countries and all Allied Governments first unanimously accepted a resolution approving the "common principles" of the Atlantic Charter, and later took the first move towards the organisation of purchasing pools, shipping facilities, etc., for the despatch of foodstuffs and other necessary materials to Europe as soon as Germany has been driven from the territories which she has now exploited and enslaved.

On behalf of the British Government, Mr. Anthony Eden, Foreign Secretary, proposed a six-point resolution declaring

(1) That raw material, food and other supplies should be made available to liberated Europe.

(2) That plans should be co-ordinated, though each country will bear responsibility for its own needs.

(3 That each country shall collaborate.

(4) That each country shall prepare estimates in every category, and indicate priorities.

(5) That plans for shipping facilities shall be made as soon as possible.

(6) That a bureau should be established in the United Kingdom to collate and co-ordinate estimates and present proposals to an Allied Committee under the chairmanship of Sir Frederick Leith-Ross.

The resolution was generally accepted by the delegates. M. Maisky, however, for the Soviet Union, said that the proposed bureau should have an international character, and that the Soviet Government could not accept proposal six as it stood. Mr. Eden expressed himself entirely willing to accept revisions on the lines suggested.

## MINISTRY OF FOOD

### Drying Plants

The Ministry of Food is compiling a register of drying plants, in use or idle, which may be suitable for vegetable drying either immediately or after adaptation.

Information is particularly required regarding tray driers (cabinet and tunnel conveyor driers) and rotary driers.

Owners of such plant should inform the Ministry of Food, Dehydration Branch, Bay View Road, Colwyn Bay, giving address of each plant. The request refers to grain-drying plant as well as other types, and it is understood the Ministry will be willing to adapt it to their requirements.

* * *

### Calcium Addition to Bread

Sir Ernest Graham-Little asked the Parliamentary Secretary to the Ministry of Food recently whether the proposal to add calcium to the fortified loaf had been abandoned in view of his announcement that the white loaf now issued does not contain that addition; and when the addition of synthetic vitamin $B_1$ would be made.

Major Lloyd George replied: The proposal to add calcium to white flour has not been abandoned. The fortification of white flour with vitamin $B_1$ has already begun in certain mills supplying the South Wales area, and will shortly be extended to other districts.

* * *

### Government and Wine Trade

Lord Hardwicke, in his speech at the recent annual meeting of Gale Lister and Co., Ltd., described official policy towards the wine and spirit trade as being "not so easy to comprehend". "The trade (he explained) has been subjected to severe tax increases in order to help pay for the war. But the Food Ministry foils the Treasury's high hopes by stopping all imports, and cutting down spirit production to a very low level, while the President of the Board of Trade successfully sees to it that most of the available whisky is sent abroad."

* * *

### Wheat Stocks

Lord Woolton, speaking at Norwich, said that we now had bigger stocks of wheat than we had ever had in the history of this country. We had been very foolish in our agricultural policy, for we never visualised the time when we might have to rely on our own land for our own food.

We owed a great deal to our bakers. During the whole time that this country was being bombed, when bakeries were knocked out and supplies of gas and electricity were disrupted, there was no single town that ever went short of bread, even on the day after the worst raid we ever had.

* * *

### Food Prosecutions

During August there were 2,524 prosecutions under the Food Control Orders, of which 2,336 were successful.

### Baked Beans

Canned baked beans in tomato sauce have been freed by the Ministry of Food for immediate sale to the public.

Stocks are already flowing into the shops.

The ban on the distribution of stocks of canned vegetables, however, will continue so long as fresh vegetables remain plentiful.

* * *

### Rationed Foods for Roadside Cafés

The Ministry of Food has instructed food officers to review the allowances of rationed foods to roadside cafés catering wholly or mainly for road transport workers with a view to their receiving the full allowances to which they are entitled. Increased supplies of bacon have recently been made available to these cafés, and from September 22 an allowance of cheese was made.

* * *

### Government Purchase of Cocoa

For the third year in succession the British Government has made arrangements to buy the entire cocoa crop of the Gold Coast and Nigeria. Based on trade arrangements with the Free French Administration, purchases by the British Government in the season which began on October 1 will be extended to the whole crop of the French Cameroons. The purchases will be carried out by the West African Cocoa Control Board on the same lines as in the season ending on September 30, 1941, but the price paid to the native farmers at 8s. 6d. per load of 60 lb. will be slightly higher than a year ago. It remains, however, 6d. per load below the 9s. paid in the first war season.

### Orange Powder

It is probable that South Africa will soon be sending to Great Britain supplies of orange powder which retain the full vitamin C content of fresh oranges. The question of dehydrating citrus fruit is being thoroughly investigated at the Low Temperature Research Laboratories in Cape Town, and, it is stated, although the problem of carrying out the process without destroying the vitamin content is not yet solved, there are definite indications that it is possible.

The loss of flavour in the concentrated juice can be compensated by the addition of oil extracted from the peel, but the production of a concentrated juice which retains the full vitamin C content remains the major problem.

* * *

### N.Z. Produce for U.K.

Mr. Barclay, New Zealand Minister for Marketing, told a Dairy Board conference at Wellington that butter production for export was to be limited to approximately 115,000 tons yearly. The United Kingdom, he said, had undertaken to purchase yearly for the period of the war and for one year after up to 160,000 tons of cheese at an increased price. Britain was also buying 11,000 tons of bacon in the third year of the war, he added.

### Turkish Foods for Britain

The United Kingdom Corporation, the British trading organisation in the Near East which is backed by the Treasury, announces that a new Anglo-Turkish Trade Agreement has been signed. Turkey will export foodstuffs valued at £T4,000,000 to the British Empire.

* * *

### Dried Apples from Canada

The Canadian Government has made a tentative sale of 13,500,000 lbs. of Annapolis Valley dried apples to the British Food Ministry, Colonel R. L. Wheeler, Canadian Fruit Commissioner, announced. The order, equivalent of about 1,000,000 barrels of fresh fruit, would be the largest single sale of the product ever made anywhere. Its value was not disclosed.

Before the war, the largest sale of valley dried apples to the United Kingdom totalled only 70,000 lbs. Last season a new type of product was turned out for the first time, and growers said it met with an exceptionally favourable reception in Britain.

Cecil Eidt, assistant superintendent of fruit dehydration at Kentville, Nova Scotia, said the order would assure the valley's apple-drying plants of a capacity run this year. It was not expected evaporating facilities would be increased.

* * *

### Irish Meat-Canning Industry

The Department of Agriculture in Eire has sent a delegation, under Mr. Patrick Rogan, Senior Veterinary Inspector, to London to study the most up-to-date meat-canning methods, states the *Irish Times*.

The canning of meat, and the best methods to ensure preservation and perfect condition of the product, has been the subject of much research work in recent years, particularly in Eire.

"The delegation has gone over really to draw on the mass of experience accumulated by this company in order to ensure that the firms here, particularly the firms that have recently come into existence, will perform their work in a manner that will enable the product to conform to the best standard. It is not a question of not being up to the standard, but if the Department is to exercise control properly it must be able to supervise properly."

* * *

### Thirty Waste-Concentrating Plants

Mr. H. G. Judd, the Controller of Salvage, in a recent statement to *The Times*, pointed out that the figures for kitchen waste do not include the large quantity of waste food collected by contractors from hotels and restaurants, nor that sent by rural households direct to local farmers. The Waste Food Board is now installing thirty concentrating plants in different areas for treating swill so that it can be distributed in solid form over wider areas, and thereby made available for feeding more pigs and poultry. Ordinary sterilised waste food yields £2 a ton, but when concentrated it brings £4 to £5 a ton.

## Tin Can Substitute

The cost does not justify an attempt to salvage the tin in the familiar can, but efforts are being made to find a suitable substitute for the material that serves the American home. Leading companies are reported by the Indianapolis *Star* as working on tinless containers. A new process for treating steel to resist corrosion is said to be developing satisfactorily. This substitute for the tinning has been offered to the War Department.

This research is being undertaken by Oscar B. Bach, industrial designer and metal craftsman. He has been an outstanding inventor and designer and has been called by *Iron Age* " probably the foremost metal craftsman of this country ". Mr. Bach believes that his new process not only will decrease the country's dependence on imported tin, but will lower by one-third the cost of making cans.

As an example of their resistance to corrosion, the inventor said they could be used for cosmetics, for which tins are unsuitable. They can be offered in a variety of colours, thus giving the metal containers added merchandise possibilities.

* * *

## Food Laundries

Work has been started on four food laundries for Glasgow, where food which may have been contaminated by gas will be salvaged and made usable again either for human consumption or as animal feeding. One of the corporation chemists, attached to each centre, will analyse food before and after treatment, and report before it may be removed.

Large part of the process is thorough washing and aeration. The equipment includes slabs on which certain kinds of food will be washed, hooks and racks on which aeration will take place, utensils for cutting away parts of meat, etc., which might be impregnated. There will also be a good water supply for washing purposes.

* * *

## More Canadian Bacon for Britain

The Canadian Government, under the terms of a contract signed at the end of August, which becomes operative early this month, have agreed to provide Britain in the next twelve months with 600,000,000 lbs. of bacon. This is an increase of 175,000,000 lbs. over the quota fixed by the contract about to expire. The revised price has not been disclosed, but semi-official forecasts suggest an increase of at least 50 cents a lb. on the export price.

The capacity of the packing plants will be strained to meet the new order, but they should be adequate because arrangements have been made for shipping eastward for processing carcases from the west, which now produces 60 per cent. of Canada's hogs but has only packing equipment sufficient for 40 per cent. The present supplies of bacon are adequate to meet both the export quota and the domestic needs, but by next spring restrictions on the home consumption of bacon will probably be necessary.

## Mr. E. B. Bennion

The Governors of the Borough Polytechnic, London, have granted Mr. E. B. Bennion, M.Sc., F.I.C., head teacher of the National Bakery School, twelve months' leave of absence to enable him to undertake the duties of deputy production manager for Messrs. Wilsons' Ormeau Bakery, Ltd., Belfast. This bakery is well known as one of the most efficiently organised bakeries in the kingdom.

Mr. Bennion's appointment may continue for the duration of the war. Meantime the full-time and part-time classes at the school are under the charge of Mr. James Stewart, who, apart from the fact that he is confectionery teacher, has an all-round knowledge of the trade.

* * *

## The Late Mr. M. P. Dunlop

The death of Mr. M. P. Dunlop, O.B.E., M.L.C., President of the Primary Producers' Union of New South Wales, was a heavy blow to the cause of Empire farmers' organisation and he will be sadly missed in the work to be done in connection with post-war policy.

Mr. Dunlop was responsible for the organisation of the first Empire Producers' Conference, held in Sydney three years ago in connection with Australia's 150th aniversary celebrations, and the wonderful success of the conference must have repaid him in some measure for the enormous amount of work which he did to bring Empire farmers together. The difficulties which he had to face would have appalled a man less endowed than he was with grit and determination. His hard work continued throughout the conference, of which he was elected chairman, and from the moment of their arrival in Sydney until the gathering dispersed Mr. Dunlop endeared himself to the delegates by his unfailing kindness, good humour and tact. The N.F.U. delegates who went to Sydney looked forward to welcoming Mr. Dunlop when he visited this country to attend a future Empire Producers' Conference in London. Fate has decreed that he should not make the journey. Undoubtedly his self-sacrificing labours in connection with the Sydney Conference sapped his health and strength.

* * *

## Farmers and Steam Coal

Those who use steam coal for ploughing and threshing, for sterilising dairy plants, for swill boilers or for tomato production are on the Priority List of the Ministry of Mines.

So far as current requirements are concerned, their interests will be looked after by Divisional and Assistant Divisional Coal Officers, who have wide discretionary powers. They will help consumers in accordance with their position on the priority list, on the strict understanding that the coal, when delivered, will be used only for the purposes specified. These officers know the up-to-date position of coal deliveries, and it is part of their duty to help consumers in getting their current needs.

## Moisture-Proofing Food Packages

Among recent processes for rendering materials waterproof while at the same time possessing the desired dry waxen surface, one of special interest for this purpose is a product covered by patent numbers 475,737 and 365,466, of which the specifications appeared about two years ago. Briefly, the material to be treated is first given an adherent coating by application of a mixture containing rubber latex and sodium silicate, through which the fabric is run, using a suitable immersion apparatus. Practical details of the apparatus used are somewhat scanty, although the continuous principle is observed as far as possible—*i.e.*, no intermittent actions are used and the fabric does not remain stationary throughout the treatment, according to the latest reports.

* * *

## Proofing Workers Against Colds

So successful was the inoculation against colds of Lord Nuffield's 25,000 employees during last winter that he has decided to repeat the precaution this year.

Test batches were kept under careful observation by the organisations in the various companies in the group. A typical result was that in one Midland factory 1,008 employees who were inoculated lost only 882 days due to colds, while 957 who were not inoculated lost 968 days during the same period of observation.

Thus it may be deduced that inoculation reduced the loss of work by nearly 14 per cent., demonstrating that the treatment was more than justified, especially as the inconvenience to the subjects is in most cases trivial.

* * *

## The Ryvita Co., Ltd.

From having one central bakery in November, 1940, the Ryvita Company has now, within one year of their first complete blitz, three bakeries—one at Edinburgh, one at York and a third at Leicester. Head offices are 310, London Road, Leicester.

* * *

## Canners' Convention

The Ohio Canners' Association will hold its annual convention December 9 and 10. No location has been selected. In the past Ohio Canners' annual meetings have alternated between Columbus and Cincinnati. The 1940 convention was held at Columbus.

* * *

## Australian Wheat Crop

The 1941-42 wheat harvest in the Commonwealth is officially estimated at 160 million bushels, compared with 82·5 millions last season when drought caused serious reduction.

* * *

## H.P. Sauce

Sir Patrick Hannon has been appointed Chairman of H.P. Sauce in succession to the late Sir C. Herbert Smith.

# COMPANIES

## Allied Bakeries, Ltd.

At the sixth ordinary general meeting of Allied Bakeries, Ltd., held in London, Mr. W. Garfield Weston, M.P., the chairman, said that he had referred last year to the widespread distribution of their bakeries and biscuit-making plants, and they had had cause during the year to congratulate themselves on that fortunate circumstance. On several occasions they had been able to render valuable assistance in areas which had suffered severely from air raids and had many times been called upon to assist in the supply and distribution of bread where local services had suffered more or less total disruption.

Shareholders might feel disappointed that it had been necessary to restrict the final distribution to 5 per cent., as against a final dividend of 7 per cent., together with a bonus of 3 per cent., last year, but, because of the increase in the rate of income tax and excess profits tax, it was obvious that that distribution could not be repeated this year.

The total provision of the Group for taxation for the year amounted to £657,000, a truly remarkable figure. In contrast to that, the total distribution to preference and ordinary shareholders of this company and of the two holding subsidiaries, Weston Foods, Ltd., and G.L. Bakeries, Ltd., and including the final dividend recommended, amounted to only £134,630. In other words, for every £1 which their shareholders received the Government first took nearly £5.

At the last meeting he had mentioned the unification of control of their London operating companies by the formation of G.L. Bakeries, Ltd.; that company had since acquired three other companies, and their set-up now embraced practically the whole of Greater London. Allied Bakeries, Ltd., had recently concluded the purchase of the entire share capital of the important Liverpool bakery and food distribution business of Benjamin Sykes and Sons, Ltd., established in 1869.

The credit balance available was £80,836, compared with £159,820 in 1940, and the directors recommended a final dividend of 5 per cent, less tax, making 10 per cent. for the year.

The report was unanimously adopted.

* * *

## C. and E. Morton

The C. and E. Morton capital reorganisation plan has been withdrawn and another is to be submitted. This was announced on behalf of the Board at the meeting held recently.

The proposal, which was criticised in *The Financial Times*, of September 2, was directed to the reduction of the capital by £225,000 to £265,000 by cancelling 10s. of each of the 225,000 8 per cent. Cumulative £1 Preferred Ordinary and 5s. of each of the 450,000 10s. Ordinary shares. Arrears on the 400,000 7 per cent. Cumulative £1 Preference shares were to be cancelled and as from January 1, 1941, interest was to be reduced to 5 per cent. Of any balance of profit remaining in any year, one-fifth was to be applied to a further dividend on the Preference and the other four-fifths on the Ordinary, which are privately held.

The proposals met with much opposition, which was supported by the Association of Investment Trusts.

Mr. E. G. E. Taylor, joint managing director of C. and E. Morton, announcing the withdrawal, said that neither the Board nor any section of the shareholders had any desire to force on the Preference shareholders any reorganisation which they did not regard as being one which they could reasonably be expected to accept. The Board, therefore, had unhesitatingly decided not to proceed with the present scheme and did not propose to submit the resolutions which appeared on the agenda.

They were, however, convinced that the interests of the Preference shareholders themselves called for some reorganisation, because the present burden of taxation made it inevitable that, so long as war conditions continued, the company could not avoid a further accumulation of Preference arrears, or make any provision for the needs which must be met immediately the war came to an end if the position of the Preference shareholders was to be adequately protected. After further consideration of the position the Board would therefore take a suitable opportunity of again bringing the matter before the shareholders.

* * *

## Batchelor and Co. (Ireland) Ltd.

At the first public meeting of the company, a dividend of 6 per cent. actual (less income tax) was declared.

The chairman, Mr. James E. Lalor, said that the manufacture of some lines had to be curtailed owing to the impossibility of obtaining American and Continental produce, but those were, fortunately, the lesser important canned products, having a limited sale. The company was at all times in the fortunate position of being able to supply the trade with its main lines on which its reputation had been built up. The new season's crop of peas for both cans and packets was late owing to climatic reasons, but supplies of canned garden peas had already reached the distributing trade.

Early this year the manufacture of canned meat products was begun and large contracts had been satisfactorily filled.

Advantageous contracts were also made involving the export of similar products to Great Britain.

* * *

## National Canning Company

At the annual meeting of the company, Mr. W. S. Smedley, the chairman, presided.

The annual report of the directors stated that the net revenue for the year, after providing for income tax, E.P.T., depreciation and expenses, amounted to £49,415 18s. 7d., to which was added the balance brought forward from last year of £41,761 7s. 4d., making a balance available of £91,177 5s. 11d. The directors recommended this should be appropriated as follows: Preference dividend of 5 per cent. per annum (less tax) for the year to December 31, 1940, £2,875; 10 per cent. per annum (less tax) on the Ordinary share capital £21,250; transfer to reserve account £15,000; leaving to be carried forward the sum of £52,052 5s. 11d.

The report and the consolidated balance sheet of the National Canning Company and its subsidiaries, with the recommended dividends, were approved.

The Chairman referred to some of the activities of the company and particularly to that of jam making, remarking that it was a profitable business. "I have found if you make really good jam, jam from fresh English fruit," he said, "the public like it and are willing to pay for it." He also spoke of the expansion of the business in the manufacture of tinned soups and said that their orders today were much greater than they could execute. He also mentioned the many restrictions to which the industry was subject, and declared that that only made more work because when they could not produce one commodity they found something else to take its place.

* * *

## Smith's Potato Crisps (1929)

The directors of Smith's Potato Crisps (1929) announced an interim dividend of 7½ per cent., less tax, on the Ordinary shares, payable October 23. A similar dividend was paid last October, and with the final of 20 per cent. and cash bonus of 5 per cent. made 32½ per cent., less tax, for 1940-41.

Issued capital is £376,228 5s. in 5s. shares.

## Miscellaneous Chemicals Control

The Ministry of Supply announces that responsibility for the following chemicals has now been transferred to the Miscellaneous Chemicals Control, Iron Trades House, Grosvenor Place, S.W. 1 (Controller, Mr. D. J. Bird):

Caustic potash.
Carbonate of potash.
Lactic acid and lactates.
Lithopone.
Phthalic anhydride and phthalates; maleic acid and anhydride.

The transfer of responsibility for titanium dioxide, chromium pigments and compounds and chlorates has already been announced.

On other miscellaneous chemicals correspondence should, until further notice, continue to be addressed to the Raw Materials Department, Ministry of Supply, The Castle, Warwick.

* * *

## Community Feeding in Dublin

Dublin Corporation, in special meeting recently, decided to co-operate in a scheme for community feeding, and recommended the City Manager to arrange for special food depôts with reserve stocks of food to the amount of £100,000.

# INFORMATION AND ADVICE

## Rusted Metal Drums—Ice Cream Manufacture—Brown Sauce—Information Supplied—Information Required

### Rusted Metal Drums

7,381. *I should be most grateful for your advice as to how I should treat some cwt. metal drums which have become rusted inside. I want to use them for malt extract, but there is no paraffin oil available to use in cleaning. For some years past I have been a subscriber to* FOOD MANUFACTURE. (Dublin.)

You might try washing them out with diluted commercial sulphuric acid, say, strong sulphuric acid diluted 20 times. This solution should be put in sufficient quantity thoroughly to wet the whole of the inside of the drums and well shaken. This should only take a matter of a few minutes, when the acid should be poured off and the metal drums put under a tap of running water. It is very necessary, of course, that all acid should be rinsed away.

Do not put the stopper on the barrels while carrying out the acid treatment, and also be very careful to see that the operator is not smoking, because hydrogen is liberated and is mixed with the air in the drum, forming an explosive mixture, and a serious accident might occur if this is ignited. Pending the use of the drums, I suggest that you leave them completely full of water to ensure that there is no air-pocket, as rust would occur.

### Ice Cream Manufacture

7,387. *We read with much interest your article, "Ice Cream Manufacture in 1941". Since milk powder of any type is now practically unobtainable, can you recommend an alternative? Also can you supply us with a formula for synthetic cream and a formula for making salad dressing? We have an emulsifying plant.* (Harrogate.)

The only alternative for a milk powder ice cream powder would be a hot mix one, the main base of which would be starch, or a combination of several starches, supplemented by such materials as dried whole egg or yolk, or a mixture of both, soya bean flour, etc.

Your only possible alternative to a powder of this hot-water type would be a powder which would give a simple water ice. This would consist of sugar, a sugar substitute, *e.g.*, "Dextrolact" (name of supplier given), citric or tartaric acid, stabiliser and fruit flavouring (powdered material). "Dextralact" is useful, but is used in limited proportions. If you have insufficient sugar to serve the purpose—you may have enough on hand to make a limited quantity of powder—then there is nothing to be done in the way of a powdered water ice mix.

With regard to a formula for synthetic cream and salad dressing, as this involves the use of oil and milk powder for its manufacture, this is not feasible at the present time, unless you have a licence for supplies.

### Brown Sauce

7,430. *Can you supply us with a recipe for a good brown sauce, having consideration to the scarcity of materials at the present time?* (Sheffield.)

The question of manufacture of sauces is a difficult one, as without some actual experience mere recipes are not much use. By far your best plan is to get the help of a practical expert to make up samples to your requirements and start you off on the actual manufacturing side.

You might try your hand at the following, which is a fairly cheap product:

| | |
|---|---|
| Dates | 1½ boxes |
| Apple pulp | 2 gal. |
| Tomato pulp | 1 ,, |
| Onions | 18 lb. |
| Garlic | 2 ,, |
| Salt | 4 ,, |
| Cayenne | 1½ ,, |
| Ginger | 1½ ,, |
| 16-grain malt vinegar | 26 gal. |
| 80 per cent. acetic acid | ½ ,, |

Peel and chop onions and garlic. Mix the ground spices to a thin paste with water and allow to soak for 48 hours. Simmer all ingredients for 30 minutes, then pass through a fine sieve. Bottle at over 185° F.

We are aware that some of these constituents are impossible to obtain and would have to be replaced by others, and here is where an expert on the subject would come in.

### Information Supplied

6,555. *Would you kindly let me have information regarding a machine for peeling onions?* (Manchester.)

This was done.

6,621. *Would you please give me the name and address of the suppliers of Commercial Glyceryl Monostearate?* (York.)

Names and address were given.

6,666. *We were very interested to read in a back number of* FOOD MANUFACTURE *of the emulsification of oil, presumably with water for tin greasing in bread-baking, and should be very much obliged if you would send us any further details as to the proportions of which the emulsion is made and also what stabiliser is used.* (Cork.)

Source of information suggested.

6,688. *One of our dairying concerns in South Africa is considering extending their existing plant, and have enquired of us regarding suitable machinery for the manufacture of crustless cheese, including an automatic cutting and wrapping machine. They are also interested in milking machines, and cheddar cheese plants comprising vats up to 1,000 gallons each; gang presses, upright presses, curd knives and curd mills; gouda and cheddar moulds in various sizes, and it would be greatly appreciated if you could let us have the names of suitable manufacturers, either in this country, America or elsewhere, who would supply this type of equipment.* (London.)

Names were given.

7,106. *We are interested in synthetic sausage casings mentioned in your Journal, and would be obliged if you would let us know the name and address of the makers.* (Tanganyika.)

Address supplied.

7,177. *We are considering the manufacture and marketing of cake flour. Can you help us, please?* (Dover.)

The name of an expert was given.

7,178. *We should be pleased if you could let us have the names and addresses of suppliers of conveyor belt.* (Dublin.)

This was done.

7,235. *We should be much obliged if you would let us have a recipe for the manufacture of browning.* (Dublin.)

The manufacture of browning is a somewhat technical matter and it would hardly be worth your while to make it on a small scale when you can obtain it ready made. Names of makers of caramel were supplied.

7,247. *Would you be good enough to let us know manufacturers in this country of: (1) Plant for the preparation of all kinds of vegetables for canning purposes. (2) Cheese-mixing equipment?* (London.)

Names were given.

### Information Required

7,816. *Can you inform us of possible edible outlets for brewer's dried yeast (unextracted), as we cannot but think this should be of value in some department of food manufacture? It is a dry and somewhat flakey powder of pleasant smell with a "meaty" or malt-like taste, containing not less than 42 per cent. of albuminoids. It is dried at a fairly high temperature, but, even so, probably a proportion of the yeast cells remain active, and we are not quite sure whether this would be regarded as an advantage or otherwise.* (London.)

# RECENT PATENTS

*These particulars of new patents of interest to readers have been selected from the "Official Journal of Patents", and are published by permission of the Controller of H.M. Stationery Office. The journal can be obtained from the Patent Office, 25, Southampton Buildings, London, W.C. 2, price 1s. weekly (annual subscription £2 10s.).*

### Abstracts of Recent Specifications

*Group Abridgments can be obtained from the Patent Office, 25, Southampton Buildings, London, W.C. 2, either sheet by sheet as issued on payment of a subscription of 5s. per Group Volume, or in bound volumes price 2s. each.*

## Improvements Relating to a Method of Stabilising the Colour of Vegetables During Canning and Storage

The invention relates to a method of canning green vegetables which prevents to a large extent the loss of the natural green colour as well as the natural flavour and texture during the commercial process of sterilisation by heat, and is particularly directed to a method of canning which inhibits the loss of pigment magnesium by maintaining a slight alkaline condition within the vegetable tissue throughout the successive steps of the canning operation, while controlling ionic equilibria to preserve natural texture.

A method is provided of canning green vegetables such as peas, spinach, asparagus, green beans and the like, featuring the use of chemical reagents selected on the basis of the anionic characteristics of vegetable tissue itself. These anionic characteristics present a twofold aspect. On the one hand, the vegetable tissue possesses the property of uniting with various cations or of establishing with a water solution a definite cationic equilibrium which is determinative in regard to the texture of the vegetable. On the other hand, the vegetable tissue possesses to a high degree a buffer capacity which renders it unnecessary to use "mild" alkaline reagents or "buffer salts" for the purpose of *p*H control.

An object of the invention is the provision of a method of canning, utilising in the various steps of procedure chemical reagents whose cations exert a favourable influence as to texture at each stage of the canning procedure.

A further object is the provision of such a canning method wherein the distinctive buffer capacity of the vegetable tissue itself is recognised in the *p*H control, and accordingly drastically alkaline hydroxides are used in small concentration.

The invention involves the principle of the base-exchange or cation-exchange property of plant tissue, which has been neglected heretofore in methods of canning vegetables for the retention of colour. This principle is of equal importance with the principle of *p*H control in producing a desirable product.

The invention describes a method of stabilising the natural green colour of vegetables during canning, which comprises pre-treating the vegetables by immersion in a solution containing a drastically alkaline reagent in which sodium is the cation at a temperature not exceeding room temperature to establish an alkaline reserve, subjecting the vegetables to a blanch solution containing calcium hydroxide, to protect the product against rupture and to maintain the alkaline reserve, adding a brine containing magnesium hydroxide to the vegetables to establish a desirable texture and to continue the maintenance of the alkaline reserve, and processing by heat.

The alkaline reagents used in the pre-treating solution may be sodium carbonate or sodium hydroxide, and in the case of the latter the vegetables are immersed for thirty minutes in a one-tenth normal solution of sodium hydroxide at a temperature not exceeding 70° F.

The blanching solution comprises a 0·005 molar solution of calcium hydroxide.

Methods are claimed in which the brine added to the vegetables comprises a sugar-salt brine which is also a 0·02 molar suspension of magnesium hydroxide, and in which the processing by heat is effected rapidly at a high temperature and the vegetables thereafter quickly and thoroughly cooled.

After processing, the vegetables are maintained at a temperature not exceeding 55° F. but above freezing.

*537,535. American Can Company.*

### Specifications Published

*Printed copies of the full Published Specifications may be obtained from the Patent Office, 25, Southampton Buildings, London, W.C. 2, at the uniform price of 1s. each.*

538,063. Lever Bros. and Unilever, Ltd., Barber, C. O., and Trotter, R. L.: Method and apparatus for the grading of fish according to size.

538,148. South Metropolitan Gas Co. and Chandler, D.: Gas cookers.

538,156. Tennant, W. J. (Refining, Inc.): Processes of and apparatus for refining vegetable and animal oils containing free fatty acids.

538,187. Cherry-Burrell Corporation: Agitators for ice-cream freezers and other machines.

538,188. Cherry-Burrell Corporation: Evaporators for refrigeration apparatus, particularly for use in ice-cream freezers, including such evaporators.

538,191. Emulsions Process Corporation: Process and apparatus for treating yeast.

538,264. McCulloch, M. L.: Device for sealing leaks in containers.

538,270. Federated Foundries, Ltd., Primrose, J. M., and Cunningham, E.: Doors for ovens and other cooking apparatus.

538,280. Booth, R. S.: Coffee urns.

538,347. American Zinc, Lead and Smelting Co.: Fertilisers.

538,376. Crown Cork and Seal Co., Inc.: Method of and apparatus for packaging beverages.

538,437. Huzenlaub, E. G., and Rogers, J. H.: Process for the treatment of rice and other cereals.

538,441. Distillers Co., Ltd., and Underwood, A. J. V.: Refrigeration systems.

538,510. Woods, S.: Manufacture of coffee substitutes.

538,566. Drachenberg, R. E.: Macerating and juice-extracting devices.

538,579. Electrolux, Ltd.: Oil-fired heating devices for refrigerator cabinets.

538,662. Chambers, C. F. M., and Burroughes, G. S. L.: Potato planting and harvesting machines.

538,664. Corn Products Refining Co.: Production of fudge and grained icing.

538,755. Murray Deodorisers, Ltd.: Method of treating ice-cream mixes.

538,769. King's Patent Agency, Ltd. (Pearson, C. W.): Process for preparing syrup for use in pineapple canning.

538,832. Evans, D. J.: Filters.

538,944. Adler, R.: Water purifying and softening apparatus.

538,961. Proctor, A.: Method of and means for drying crops.

## TRADE MARKS

*The list of trade marks of interest to readers has been selected from the "Official Trade Marks Journal" and is published by permission of the Controller of H.M. Stationery Office. The journal can be obtained from the Patent Office, 25, Southampton Buildings, London, W.C. 2, price 1s. weekly (annual subscription £2 10s.).*

**CONQUEST.**—614,686. Flour. **E. C. Robson,** Bishopwearmouth Flour Mills, Chester Road, Sunderland; Millers. (Associated.)

**PLEX.**—614,765. Chocolate and confectionery, flour and preparations made from cereals, bread, biscuits (other than biscuits for animals), cakes and pastry. **Rowntree and Co., Ltd.,** The Cocoa Works, Wigginton Road, York; Manufacturers and Merchants.

**LING-FO-EGG.**—614,778. Egg and flour pastes for food and egg powder. **Joseph Lingford and Son, Ltd.,** 5, Durham Street, Bishop Auckland, Durham; Manufacturers. (Associated.)

**GINOATIS.**—614,800. Biscuits containing oatmeal not being biscuits for animals. **Ernest Stanley Wallbridge,** 27, Preston Road, Southport, Lancashire; Manufacturer.

**VITEEM.**—614,824. All goods included in Class 30. **Atomised Food Products, Ltd.,** Bessemer Road, Welwyn Garden City, Hertfordshire; Manufacturers. (Associated.)

**RABVITA.**—614,874. Foodstuffs for animals. **E. Griffiths Hughes, Ltd.,** Peru Street, Adelphi, Salford, Manchester; Manufacturing Chemists.

## NEW COMPANIES

**Speciality Food Conserves, Limited.** (365720.) Room 377, 329, High Holborn, W.C. 1. To carry on the bus. of mnfrs. of and dlrs. in fish and other preserves and paste, etc. Nom. cap.: £100 in £1 shares. Permt. dirs.: A. Miller, M. Engel and J. Pudre; addresses not stated. Subs.: H. C. Johnson, Room 377, 329, High Holborn, W.C. 1 (clerk); Jacqueline P. Ingram, Room 377, 329, High Holborn, W.C. 1 (clerk).

**D. J. Winson and Company, Limited.** (364982.) To carry on bus. of dlrs. in provisions, foodstuffs, produce, etc. Nom. cap.: £100 in £1 shares. Dirs.: Not named. Subs.: E. W. Hopton, 11, Church Lane Drive, Hooley, Coulsdon, Surrey (cashier); E. Walter, 21, Orchard Avenue, Shirley, Surrey (clerk).

**Somerset Creameries, Limited.** (364890.) Seliaks House, The Hill, Langport, Som. Nom. cap.: £1,000 in £1 shares. Dirs.: F. S. Skailes, The Gables, Epping, Essex; G. A. D. Skailes, Wedgwood, Princes Avenue, Woodford Green, Essex.

**B. and G. Trading Co. Limited.** (365354.) 1-3, Stanley Street, Liverpool. To carry on the bus. of wholesale or retail mnfrs. of and dlrs. in flour, bran, bread, etc. Nom. cap.: £100 in £1 shs. Dirs.: A. N. Bevan, 92, Elm Hall Drive, Liverpool; W. A. Gamble, 126, Meols Parade, Hoylake.

**Semolina Food Products Limited.** (365369.) Empire Way, Wembley Park, Middlesex. Nom. cap.: £2,000 in £1 shs. Dirs.: R. A. Bodega, 193, Hale Lane, Edgware, Middlesex; C. E. M. Invernizzi, 36, Purcell's Avenue, Edgware, Middlesex.

**New Zealand Cheese Limited.** (365596.) 155-7, Minories, E.C. 3. Nom. cap.: £1,000 in £1 shs. Dirs.: E. G. E. Taylor, Staplegordon, Seale, Farnham, Surrey; Brigadier J. Buckley, D.S.O., M.C., Effingham Manor Golf Club, Effingham, Surrey.

*Taken from the Daily Register, compiled by Jordan and Sons, Limited, Company Registration Agents, 116, Chancery Lane, London, W.C. 2.*